No. 203 BULLETIN JANUARY, 1940
OF THE
OHIO STATE UNIVERSITY AGRICULTURAL COLLEGE EXTENSION SERVICE

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Feed Consumed by Livestock:

A Guide for Planning the Farm Organization

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THE OHIO STATE UNIVERSITY, COOPERATING WITH THE U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL EXTENSION SERVICE—H. C. RAMSOWER, *Director*, Columbus, Ohio
FREE—Cooperative Agricultural Extension Work—Acts of May 8 and June 30, 1914

Contents

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Foreword

THE DATA contained herein have been compiled in practically all cases from the published results of feeding experiments and cost of production studies at the agricultural experiment stations and colleges in the various states in this country. The purpose of assembling such data was to have, in usable form, information that will help in estimating the number of livestock that may be carried on a given quantity of feed, or the amount of feed that will be consumed by a given number of livestock. The necessity and desirability of reorganizing the farm units more frequently to better fit changing conditions has created a need for this type of data for use in making individual farm plans.

An attempt was made to use data obtained in areas where feeds and feeding conditions were as nearly similar to those existing in Ohio as was possible. Where several experiments were grouped and averages used, care was taken to combine only those where the characteristics of the animal, the type of feed, and the method of management (based on the description accompanying the published results of the test or study) were believed to be similar.

The material presented has not been set up or in any way intended to be an appraisal of the various rations and methods of feeding, or to advocate one system in preference to another. For this type of information, the reader is advised to consult the livestock specialists, and literature dealing with methods of feeding and management of livestock.[1]

The author wishes to express his appreciation for the cooperation and assistance given him by members of the College of Agriculture and Extension Service Staff of the Ohio State University, and in particular for the valuable suggestions and criticisms given by the members of the Departments of Animal Husbandry and Poultry Husbandry. He also wishes to acknowledge the use of the data obtained from the results of many animal feeding experiments and cost of production studies conducted by numerous Agricultural Experiment Stations and Colleges throughout the country.

[1]Such information may be obtained from the Departments of Animal Husbandry and Poultry Husbandry at the Agricultural College and The Experiment Station in Ohio and other states. A partial list of bulletins on feeding and management of livestock published by the Agricultural Extension Service is: No. 59, Raising Chicks; No. 68, Sheep Raising in Ohio; No. 72, Feeding Dairy Cattle; No. 78, Pork Production in Ohio; No. 126, Poultry Feeding; No. 130, Beef Cattle Feeding; No. 147, Save the Foals.

Feed Consumed by Livestock--

A Guide for Planning the Farm Organization

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IN BUILDING the livestock and crop program on a farm, a question that arises and must be answered by the operator is how many head of cows, sheep, hens, or pounds of beef, pork, etc., will the feed grown on his farm produce or support in a normal year? Or it may be that the operator wishes to keep or produce a definite amount of livestock even though its feed requirements may exceed the amount of feed grown on that farm. In either event, the operator will find it advantageous to know fairly accurately how much feed will be needed, so that he can make his plans accordingly. In answering these questions, how much livestock and how much feed, the experienced farm operator may succeed in estimating fairly accurately, but many operators are or will be at a loss to know how to plan their livestock and feed program unless provided with some guide to follow that is more tangible than individual experience.

Inasmuch as there is a wide variety of rations and methods of feeding for each type of livestock, one standard for each type of livestock is not feasible; neither is it possible to provide a standard for all methods and rations. Only for the more common rations and methods of feeding are satisfactory data available on the quantities of feed consumed or required per year per head or per hundredweight of gain. In actuality, most rations and methods of feeding practiced will sufficiently resemble one of the more common rations on which information is available, that substitution and adjustments may be safely made.

Guides to determine the number of livestock to feed or the amount of feed needed for a given number of livestock, have definite limitations. If these limitations are fully understood and proper adjustments made, little or no difficulty need be experienced in using them.

These limitations are of two types. One type deals with those weaknesses contained in the data on the quantity of feed consumed by livestock; the other type of limitations refers to the difficulties involved in determining the quantity of feed available or that may be available for feeding livestock. The problems involved in connection with the latter of these general limitations is more fully discussed on page 6 under the heading, "Determining the Quantity of Home Produced Feeds Available for Livestock."

Four Factors Limiting the Use of the Data

1. *Variation in Quality of Feed.*—One of the most significant limitations of the data on the quantity of feed consumed by livestock is the fact that the quality of feed grains, roughages, and pastures varies from year to year, and in the same year there will be variations between farms and between areas. It is well known to livestock men that in some years a bushel of corn will produce more gain than in others. Similarly, a given quantity of leafy green hay will produce better results than a greater quantity of hay of lower quality, whether due to being

cut too late, rained on too much, or foul with weeds. In wet seasons, usually both pasture and hay contain less feeding value per unit of weight than in dry seasons. Corn silage will vary in its feeding value as the quantity of grain and stover varies and with the stage of maturity when placed in the silo.

2. *Variation in Quality of Livestock.*—A second limitation on the use of the data on the quantity of feed consumed by livestock is the variation in the livestock being fed. Diseased and parasite ridden livestock make slower gains, are subject to more death loss, and in general will require more feed for a given production than healthy animals. Stunted animals, like diseased animals, are handicapped. Poorly bred animals frequently make slow and costly gains; or in the case of the dairy cow, or hen, the production of milk and eggs is limited by the individual inherited capacity to produce. In other words, the same quantity and quality of feed and care given to a good individual as a result of good breeding will produce proportionately more than the same feed and care given a low producing animal.

3. *The Human Factor.*—A third limitation in the use of the data on feed consumption is the human factor. One man can take a given quantity of feed and livestock and, due to his skill, produce more than his neighbor. The much quoted statement, "The eye of the master fattens his cattle," is significant; the owner's interest does influence both the rate of gain and the quantity of feed required for a given amount of gain.

4. *Farm Conditions More Variable Than Experimental Conditions.*—The accuracy of the data itself, and the fact that experimental work is usually conducted under circumstances that are not entirely comparable with typical farm conditions is also a limitation. Generally, disease and parasites are better controlled, and better producing animals are used in the tests than are found on many farms. On the other hand, the quality of feed used in these experiments, although generally good, is usually obtainable by most farmers, and the equipment used in these tests, though more elaborate than on the typical farm, is generally considered to add little that cannot be obtained economically on the average farm.

The adequacy of the data in a few cases may be reasonably questioned, because of the limited number of cases or trials. The same ration and method of feeding applied to several different lots of livestock over a period of years in the experimental feeding trials shows considerable variation from lot to lot and year to year, because of differences in quality of feeds, health of the animal, and the like. The fact that this guide to the quantity of feed consumed is an average of several trials which have varied to some degree from the average itself must be recognized. This must be kept in mind when using these averages as a guide, for the results of the individual feeder probably will vary somewhat from that average in most cases, and in some the variations may be fairly marked. If, however, the ration has been amply tested, the average will be fairly typical when other conditions are similar.

In light of these limitations it is advisable, when using these data as a guide, to appraise your own ability as a feeder, your equipment, the quality and health of your livestock, and the quality of your feed, then adjust accordingly.

Determining the Quantity of Home-Produced Feeds Available[1]

The usefulness of this guide to feed consumption or requirements depends to a great extent upon the accuracy with which the amount of feed available for the livestock can be or is determined. A too great an over-estimation or under-estimation of the amount of feed available will result in disappointment. Thus great care in determining the amount produced or in estimating the amount that will be produced must be exercised.

Farmers who have operated the same farm or farms for a number of years generally know what their crop yields will average and what the carrying capacity of their pastures are. For the farmer who is operating a farm that is new to him, the crop yield history and the carrying capacity of the pasture may be obtained with a fair degree of accuracy by talking with former operators and neighboring farmers, and by making an appraisal of the productive capacity of the land.

Corn.—As a general rule, the amount of corn produced and the yield per acre are determined by the farmer in the fall, at the time the corn is stored and at the time of year when the new corn carries a large amount of moisture. According to data obtained at the Illinois Agricultural Experiment Station in a study on the cost of storing corn, well matured corn comparatively dry when husked will shrink between November and the following summer around 14 or 15 percent, and corn that goes into the crib in the fall in a rather sappy condition will shrink 18 to 20 percent and in some cases more. The average shrinkage during nine years of testing was 16.2 between November and July.[2]

A 50-bushel per acre corn yield determined at the time it is stored in the fall, will amount to a yield of approximately 42 bushels per acre of dry corn.

In determining the quantity of corn available for feeding livestock, it is necessary to take into account normal shrinkage, as all the data contained in this publication on the quantity of corn consumed by livestock is on a dry weight basis, unless otherwise indicated.

Other Grains.—A fairly exact yield of other grain crops, such as oats, barley, rye, wheat, and soybeans, is generally known at the time they are harvested, or may be determined by calculating the cubic contents of the stored grain and then dividing it by 1.25 cubic feet, the approximate cubic content of a bushel of small grain. Shrinkage on these grains is generally of minor significance, as they must be fairly dry in order to be safely stored; thus it is not necessary to make any adjustment for shrinkage in the case of small grains.

Hay.—The quantity of hay produced is generally estimated by farmers by counting the number of loads of hay made and then on the basis of their estimate of the number of pounds of hay per load determine the number of tons produced. This involves the problem of estimating the amount of hay per load, and unless one has actually weighed a load of loose hay and thereby has some fairly clear standard of measure to go by, there is likely to be a wide margin of error in this method.

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[1] See Common Methods for Computing Quantities of Stored Feeds, pages 94 5

[2] Illinois Agricultural Experiment Station Bulletin 295

For many years each load of hay made on the Ohio State University farm has been weighed when it came from the field. Over a period of years these loads have averaged 1.75 tons of field cured legume or mixed hay (predominantly alfalfa and alfalfa mixed with some clover and timothy). Due to the great distance that the hay must be hauled at the University farm, an extra effort has been made to haul large loads. The racks used are 16 feet long, 7 feet wide, with 7-foot standards or uprights across each end; the racks are at present mounted on low-wheeled rubber tired wagons drawn by tractors. The hay is loaded to an average depth of 9 feet and approximately 12 feet in width. The loading is done by a hay loader with two men on the wagon.

The loads of hay as they come from the field on a few farms where a tractor or two teams are used to draw the wagon when loading, and where a large hay rack is used, will probably average as large as those hauled on the University farm. These loads are, however, considerably larger than the average load of hay made in western or northern Ohio, and at least twice as large as the typical load made in the hillier parts of the state.

On most farms where hay is properly made, there is considerable moisture in the hay at the time it is stored and some shrinkage occurs. Rarely is hay so dry when stored that it could be safely bailed immediately without spoilage, but hay that is dry enough to bail when stored will shrink approximately 10 percent in weight after storing, and as a rule is not first class hay. Under average conditions, legumes and mixed hays will shrink 15 to 20 percent after storing, and timothy 10 to 15 percent. Thus, if the quantity of hay available for feeding is determined by estimating the weight of hay put in the mow or stack, it will be necessary to make an adjustment for shrinkage, as all of the hay consumption data in this bulletin are on a dry weight basis.

A second method is to determine as accurately as possible the volume in cubic feet of the settled hay in the mow or stack and then compute the tonnage by dividing the total volume of hay by the cubic feet required for a ton of dry hay. In a recent study in which several of the western states cooperated with the federal government in measuring and then weighing the contents of stacked hay, the average amount of alfalfa hay required for a ton after the hay had been in the stack 65 to 90 days was approximately 500 cubic feet; and timothy and mixed hay 625 cubic feet.[1] In both cases there was a wide range between the maximum and minimum number of cubic feet of hay required to make a ton. The more compact and dense the hay was in the stack, the greater was its weight per cubic foot. The degree of compactness of hay in a mow or stack tends to increase as the depth of the mow or stack increases. Likewise, hay that contains a rather large amount of moisture when stored tends to become more compact, whereas hay that is very dry when stored packs less and consequently weighs less per cubic foot.

Corn Stover.—The quantity of corn stover produced per acre varies with the variety of corn and the yield of grain per acre. According to data assembled by the Ohio Agricultural Experiment Station some years ago, approximately 1500 pounds of corn stover is produced when the corn yields 30 bushels per

[1] United States Department of Agriculture Technical Bulletin No 239.

acre, 2000 pounds when it yields 40 bushels, and 2500 to 3000 pounds when it yields 50 bushels.

Determining the Amount of Livestock to Keep

It is generally not considered a safe farm practice to stock one's farm to the limit of one's feed, particularly roughages and pasture, unless prepared to go on to the market and make up the deficit, if one should develop. When a scarcity arises, it is usually the result of unfavorable weather which is not restricted to an individual farm but may affect large areas, and, when such an emergency develops, additional feed is either not available locally, or if available, only at high prices. Most conservative and experienced operators plan to have slightly less livestock than their normal feed supply will carry. They thus have some leeway in feeding and may carry their livestock longer, feed heavier, sell the surplus feed, or hold until another season.

Some experienced and successful feeders make a practice of purchasing additional feed and feeding more livestock than the normal feed crop production on their own farms will support. Where such a procedure is followed, less risk is involved if the quantity of feed needed is fairly accurately known in advance and plans for its procurement made.

Inasmuch as it is a safe and usually a sound program for most farmers to plan to have a little feed left over, then in using these data as a guide to feed requirements in determining the amount of livestock to keep and to feed, it may be advisable to reduce the quantity of livestock somewhat below the number determined by the use of the data contained herein, due both to the limitations of the data themselves and to the inadvisability of overstocking. If, after a year or two, the farm operator finds that he is having more surplus feed on hand than he desires, he may be underestimating his ability as a feeder and will find it advantageous to add more livestock if he desires to utilize more of his feed crops. He may also over-estimate his carrying capacity at the start and find it necessary to reduce the number of livestock; this usually is a more costly adjustment than selling surplus feed.

It is well to use this material conservatively at the start until it is known how well it fits the individual operator and his feeding conditions.

☞ All data on the quantity of grain and hay consumed or required annually or for a given amount of production in this bulletin are on a dry weight basis, unless otherwise stated. Thus an adjustment for normal shrinkage due to loss of moisture after storing must be made for corn and hay before calculating the amount of livestock that these feeds will support. (See text, page 6, for information on the determination of the quantity of farm-produced feeds available for feeding.)

Part I -- The Beef Enterprise

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Contents

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List of Tables

The Beef Enterprise

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SEVERAL METHODS of conducting the beef enterprise are practiced by farmers in the corn belt. Some farmers keep a herd of beef or dual purpose cows and produce all or part of their own feeder cattle. Others buy feeders from neighbors, the market, or direct from the range. When feeders have been obtained, a common practice among farmers is to finish them in dry lot. Other producers either rough their feeders through the winter or buy them in the spring, to be fattened on pasture alone or with grain. A few follow a combination of pasture for part of the feeding period and finish them in dry lot.

A majority of the data available on rate of gain and quantity of feed consumed to produce a hundredweight of gain is on the dry lot method of beef production. The quality and quantity of feed consumed are more readily determined for this method than for those in which pasture constitutes all or a part of the feed.

The wide variation in both the quantity and quality of pasture and roughage between farms and from year to year has tended to limit the amount of data on gains made on these feeds, and to limit the use of that which is available as a guide in calculating feed requirements.

Feeding results among farm producers are known to vary widely as a result of numerous differences between farms. The results of many experienced feeders, however, compare favorably with those obtained under systems of feeding and management similar to those followed at the agricultural experiment stations and colleges. Other farmers do not fare as well.

Feed Consumed Annually by a Beef Breeding Herd

A study made by the United States Department of Agriculture of feed fed on corn belt farms to beef breeding herds per animal per year averaged approximately 200 days of pasture, 2000 pounds of hay, 700 pounds of corn silage, 500 pounds of straw, 2 acres of corn stalks, and 2.5 bushels of corn usually fed after freshening in the spring. (See Table 1, below.) There were many variations in rations and feeding methods followed on the farms included in this study.

Table 1. — Feed consumed annually on corn belt farms per beef cow including the calf to weaning time[1]

	Beef cows kept to produce		
	Feeders (cows part milked by calf and part by hand)	Feeders	Calves to be finished as baby beef
Number of cows under study..→	1541	11,261	4572
Pasture, days	200	194	197
Hay, lbs.	1940	1900	1940
Silage, lbs.	600	700	740
Straw, lbs.	580	660	500
Corn, bus.	4.75	2.2	2.5
Corn stalks, acres	1.75	1.42	2.0

[1] Source of data—U.S.D.A. study reported in the Agricultural Yearbook, 1921, pages 266-268. Age of calves at weaning time, 6 to 8 months.

In Ohio some farmers feed less hay to their beef cows, substituting instead corn stover that has been cut and shocked in the fall. Records kept by some farmers in this state in cooperation with the Animal Husbandry Department show the farmers were feeding during the winter per cow 750 to 1000 pounds of hay, little or no corn silage, 2 to 3 bushels of corn fed after freshening in the spring, and approximately 1.5 acres of corn stover that had been cut and shocked in the fall. Others fed more silage and less hay and grain.

On some farms where breeding herds are kept, the calves, after weaning in the fall, are wintered cheaply and turned on pasture the following spring to develop into yearling feeders before they are put into the feed lot for finishing. According to the study made by the U.S.D.A. on corn belt farms where this procedure was followed, the average amount of feed fed during the winter per calf was approximately 1250 pounds of hay, 250 pounds of silage, some straw and corn stover, and 8.5 bushels of corn. (Table 2.)

Table 2. — Feed consumed on corn belt farms per beef calf during the first winter following weaning when kept for the production of short yearlings or stocker cattle[1] [2]

Number of calves under study — 7236	Quantity per calf
Hay, lbs.	1218
Silage, lbs.	266
Protein meal, lbs.	7
Straw, lbs.	110
Fodder, lbs.	159
Corn, bus.	8.6
Corn stalks, acres	0.1
Pasture, days	9.0

Table 3. — Feed consumed on corn belt farms per beef calf after weaning, when finished as baby beef[1] [3]

Number of calves under study — 4009	Quantity per calf
Hay, lbs.	1150
Silage, lbs.	658
Protein meal, lbs.	141
Straw, lbs.	40
Corn, bus.	41
Pasture, days	48
Pork produced, lbs.	38.0

[1] Source of data—U.S.D.A. study reported in the Agricultural Yearbook, 1921, pages 266-268.
[2] Age of calves at beginning of feeding period 6-8 months; age at close of period 12-14 months.
[3] Age of calves at beginning of feeding period 6-8 months; age at close of period 14-15 months; weight of calves at finish 825 pounds.

Other corn belt farmers included in the U.S.D.A. study finished the calves as baby beeves, turning them into the feed lot at 6 to 8 months of age and selling them at 14 to 15 months at an average weight of 825 pounds. To do this, these farmers fed on the average per calf approximately 1200 pounds of hay, 700 pounds of silage, 150 pounds of supplement, and 41 bushels of corn. (See Table 3.)

Feed Consumed in Producing a Fairly Satisfactory Finish on Beef Animals of Different Weights

Calves, yearlings, and 2-year-olds constitute the three major weight groups that are turned into the feed lots for finishing. A greater gain in weight is required to produce a fairly satisfactory finish on calves than on two year olds, yearlings falling between calves and 2-year-old steers.

Steer calves, weighing between 400 and 450 pounds when they go into the feed lot, will in general require a gain in weight of approximately 475 pounds to

produce a fairly satisfactory finish. To produce this gain, according to Agricultural Experiment Station feeding tests, when they are fed a ration of shelled corn, supplement, corn silage, and hay, will require 38 bushels of corn, 347 pounds of supplement, 2042 pounds of silage, and 470 pounds of hay per calf. According to these tests, the average time required on feed to make this gain would be 228 days. (See Table 4, below, for further information.)

Yearling steers, weighing between 650 and 700 pounds when they enter the feed lot, will generally require a gain in weight of 375 pounds per steer to bring them to a fairly satisfactory finish. To produce this gain, according to Agricultural Experiment Station feed tests, when they are fed a ration of shelled corn, supplement, corn silage, and hay, will require approximately 34 bushels of shelled corn, 300 pounds of supplement, 2677 pounds of corn silage, and 401 pounds of hay. According to these tests, the average time required on feed to make this gain would be 176 days. (See Table 4, below, for additional information.)

Two-year-old steers, weighing between 950 and 1000 pounds when they enter the feed lot, will generally require a gain in weight of 320 pounds per steer to bring them to a fairly satisfactory finish. To produce this gain, according to Agricultural Experiment Station tests, when they are fed a ration of shelled corn, supplement, corn silage, and hay, will require approximately 31 bushels of shelled corn, 333 pounds of supplement, 3686 pounds of silage, and 419 pounds of hay. According to these tests, the average time required on feed

Table 4. — Feed consumed in fattening calves, yearlings, and 2-year-old steers with shelled corn, supplement, hay, and corn silage in dry lot

	Heifer calves[1]	Steer calves[2]	Yearlings[3]	2-year-olds[4]
Number of trials	5	46	13	18
Weight at beginning, lbs.	385	396	658	960
Weight at end, lbs.	815	884	1003	1311
Gain per head, lbs.	430	488	345	351
Days on feed	188	235	162	143
Average daily gain, lbs.	2.29	2.08	2.13	2.45
Feed required per 100 lbs of gain				
Shelled corn, lbs.	437	447	509	546
Supplement, lbs.	77	73	80	104
Hay, lbs.	84	99	107	131
Corn silage, lbs.	365	430	714	1152
With an initial weight of — lbs.	400–450	400–450	650–700	950–1000
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	350	475	375	320
Feeding period, days	153	228	176	131
Then the total feed required per head is:				
Shelled corn, bus.	27.3	37.9	34.1	31.2
Supplement, lbs.	269	347	300	333
Hay, lbs.	294	470	401	419
Corn silage, lbs.	1277	2042	2677	3686

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 129; Minn. 237; Kan. 105; Ill. (a report) 1927-28.
[2] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 93, 94, 129, 140, 166, 173, 179, and 186; Minn. 300; Iowa 271; Ind. 129; Wis. 396; Ill (a report) 1927-28; Mich. Qt. 10, 11, 13, 14, 15, 19.
[3] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 93-94, 105-106, 134, 146, 173, 179; Minn. 274.
[4] Ind. 129, 191, 240, 249, 265, 281, 371, 396; Iowa 182.

to make this gain would be 131 days. (See Table 4, page 13, for additional information.)

As the weight of the animal increases the feed required to put on 100 pounds of gain increases, but less total gain is required to produce a finished animal. To raise the weight of a steer from 400 to 500 pounds requires approximately 300 pounds of concentrates, 300 pounds of hay, and 500 pounds of corn silage. In contrast to this, approximately 700 pounds of concentrates, 450 pounds of hay, and 900 pounds of corn silage are required to raise the weight of an 1100-pound steer to 1200 pounds. (For further information regarding feed requirements for different weights of animals see Table 5, below.)

Table 5. — Pounds of feed consumed per 100 pounds of gain by steers of various ages[1]

Weight of cattle, pounds	Average daily gain	Skim and whole milk	Concentrates	Hay	Silage
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*
100– 200	0.93	1,252	91	103	6
200– 300	1.33	575	196	232	126
300– 400	1.44	160	251	291	326
400– 500	1.51	...	291	322	481
500– 600	1.85	...	283	314	438
600– 700	1.71	...	362	440	327
700– 800	1.79	...	425	480	135
800– 900	1.53	...	558	550	364
900–1000	1.62	...	550	455	715
1000–1100	1.53	...	623	449	876
1100–1200	1.48	...	714	455	899
1200–1300	....	...	821	774	1050
1300–1400	....	...	870	785	1200
1400–1500	....	...	911	563	1746
From calf to 600	1.39	433	232	264	279
From calf to 1200	1.52	194	407	385	423
From calf to 1500	....	153	506	454	618

[1] Taken by special permission of the Morrison Publishing Company, Ithaca, N. Y., from Feeds and Feeding, 20th Edition, by F. B. Morrison.

Feed consumed and rate of gain for calves, yearlings, and 2-year-old steers, according to records kept by corn belt farmers cooperating with the United States Department of Agriculture, are given in Table 6, page 15. The average amount of feed consumed and rate of gain in a series of Experiment Station feeding trials where calves, yearlings, and 2-year-old steers were directly compared is given in Table 7, page 15. A rather wide variation exists in the amount of feed consumed per hundredweight of gain and rate of gain between the steers fattened on farms (according to these records) and those fattened in the Experiment Station trials. Some of the experimental trials required more feed per hundredweight of gain than others, and some farmers among those that kept records produced their gains more rapidly and with less feed than did other farmers.

It is generally true, however, that somewhat more feed and a little less rapid gains are made under average farm conditions than in experimental work, as is indicated by a comparison of Tables 6 and 7, but some farmers

following good feeding practices produce their gains at as low a feed cost as do the Experiment Stations and colleges.

Table 6. — Feed consumed per 100 pounds of gain for fattening calves, yearlings, and 2-year-old steers on corn belt farms[1]

	Calves	Yearlings	2-year-olds
Number of lots	47	95	215
Number of steers	1761	3288	8223
Weight at beginning, lbs.	401	656	876
Weight at end, lbs.	701	919	1128
Gain per head, lbs.	300	263	252
Days on feed	176	149	141
Average daily gain, lbs.	1.7	1.8	1.8
Feed required per 100 lbs. gain:			
Grain, lbs.	648	574	702
Supplements, lbs.	62	65	86
Hay, lbs.	271	298	278
Other dry roughage, lbs.	38	79	143
Corn silage, lbs.	254	1193	1356
Pork produced per cwt. of gain on beef, lbs.	19.2	20.4	28.6
Manure produced per cwt. of gain on beef, loads	0.8	1.2	1.5

[1] U.S.D.A. Technical Bulletin No. 23. Information obtained from records kept by farmers on their beef feeding operations; it is the average of all rations fed on these farms.

Table 7. — Feed consumed by calves, yearlings, and 2-year-old steers according to feeding trials conducted at agricultural experiment stations and colleges[1] [2]

	Calves	Yearlings	2-year-olds
Average initial weight, lbs.	414	638	840
Length of feeding period, days	197	174	162
Average daily gain, lbs.	2.19	2.26	2.40
Average total gain, lbs.	431	393	389
Feed per 100 lbs. gain by steers:			
Grain, lbs.	462	586	667
Supplement, lbs.	47	45	41
Hay, lbs.	198	241	246
Silage, lbs.	186	258	308
Total feed consumed per head:			
Grain, lbs.	1990	2279	2552
Supplement, lbs.	217	188	170
Hay, lbs.	827	935	941
Silage, lbs.	808	1014	1221

[1] Taken by special permission of the Morrison Publishing Company, Ithaca, N. Y., from Feeds and Feeding, 20th Edition, by F. B. Morrison.
[2] Average of 17 experiments in which the three classes were directly compared.

☞ All data on the quantity of grain and hay consumed or required annually or for a given amount of production in this bulletin are on a dry weight basis, unless otherwise stated. Thus an adjustment for normal shrinkage due to loss of moisture after storing must be made for corn and hay before calculating the amount of livestock that these feeds will support. (See text, page 6, for information on the determination of the quantity of farm-produced feeds available for feeding.)

Feed Consumed in Producing a Fairly Satisfactory Finish on—

A. *Beef animals of different grades.*—Feeding tests conducted at Ohio and Pennsylvania Agricultural Experiment Stations in which good, medium, and common quality yearling steers were compared, showed that the quantity of feed consumed in the production of 100 pounds of gain was almost identical. At the end of the feeding period in each case the common steers were still common and the good steers were still good. In other words, the gain in weight (which was very similar for each grade) had not changed their grade, even though the total gain and the quantity of feed consumed by each grade was very similar. (See Table 8, below.)

Table 8.—Feed consumed in fattening common, medium, and good yearling steers with corn and cob meal, supplement, hay, and silage in dry lot[1]

	Good	Medium	Common
Number of trials	7	7	7
Weight at beginning, lbs.	662	660	644
Weight at end, lbs.	1082	1079	1047
Gain per head, lbs.	420	419	403
Days on feed	184	176	168
Average daily gain, lbs.	2.28	2.38	2.40
Feed required per 100 lbs. of gain:			
Corn and cob meal, lbs.	599	584	587
Supplement, lbs.	79	76	75
Hay, lbs.	87	87	86
Corn silage, lbs.	550	537	536
With an initial weight of — lbs.	650–700	650–700	650–700
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	375	375	375
Feeding period, days	164	158	156
Then the total feed required per head is:			
Corn and cob meal, bus.	33.0	32.2	32.4
Supplement, lbs.	296	285	281
Hay, lbs.	326	326	322
Corn silage, lbs.	2062	2013	2010

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 173; Penn. 329.

B. *Heifers and steers.*—The weight at which heifer calves reach a satisfactory finish for the market is approximately 125 pounds less per animal than in the case of steer calves. A gain of 350 pounds on a 400- to 450-pound heifer calf generally produces a satisfactory finish, whereas a gain of 475 pounds is generally necessary on steer calves. In five tests conducted at various agricultural experiment stations in which the heifers were fed for a shorter period than steer calves, both receiving the same ration but with the steers carried to heavier weights, it was found that the rate of gain and the feed required per 100 pounds of gain was almost identical. Where the heifers were fed the same number of days as steer calves, the tests showed that the gains on heifers were slightly less per day and a little more feed was required. According to tests where the heifers were marketed at weights in the neighborhood of 750 pounds, approxi-

mately 27.3 bushels of shelled corn, 269 pounds of supplement, 1277 pounds of corn silage, and 294 pounds of hay would be required to make a gain of 350 pounds. To do this, 153 days on feed will be required. Steer calves receiving the same ration but fed until they had made a gain of 475 pounds will require 228 days of feeding, during which time 38 bushels of corn, 347 pounds of supplement, 2042 pounds of corn silage, and 470 pounds of hay will be consumed per steer. (See Table 4, page 13.)

Feed Consumed in the Production of a Fairly Satisfactory Finish on a Beef Animal when Fed a Ration of—

A. *Shelled corn, supplement, corn silage, and hay* as indicated by various feeding tests will produce a gain of 475 pounds on steer calves in a 228-day feeding period with 38 bushels of shelled corn, 347 pounds of supplement, 2042 pounds of silage, and 470 pounds of hay. Yearling steers may be brought to a fairly satisfactory finish on this ration in 176 days with a gain of 375 pounds per steer, on 34 bushels of shelled corn, 300 pounds of supplement, 2677 pounds of corn silage, and 401 pounds of hay. Two-year-old steers will be brought to a fairly satisfactory finish on this ration with a gain of 320 pounds per steer in 131 days on 31 bushels of shelled corn, 333 pounds of supplement, 3686 pounds of silage, and 419 pounds of hay. (See Table 4, page 13, for additional information.)

B. *Corn and cob meal, supplement, corn silage, and hay* when fed to steer calves according to feeding tests conducted in Ohio and Minnesota will make a gain of 475 pounds per steer in 223 days on 40.8 bushels of corn and cob meal, 390 pounds of supplement, 1363 pounds of corn silage, and 465 pounds of hay. Yearling steers fed the same ration will make a gain of 375 pounds per steer in 159 days on 32.3 bushels of corn and cob meal, 281 pounds of supplement, 2133 pounds of corn silage, and 345 pounds of hay, as indicated by tests made in Ohio and Pennsylvania. (See Table 9, page 18, for additional information.)

C. *Corn silage, supplement, and hay* for fattening yearling and 2-year-old steers has been tested at several experiment stations. Due to the bulky nature of this ration and the limited capacity of calves, it has not been commonly used as a finishing ration for calves. Usually a more highly concentrated feed must be added to bring the calves to a finished condition.

To put on a gain of 375 pounds on yearlings and 320 pounds on 2-year-old steers would require approximately 9000 pounds of corn silage, 350 to 450 pounds of supplement, and 400 to 700 pounds of hay per steer, according to various feeding trials in which yearling and 2-year-old steers were fed this ration. An average feeding period of 174 days will be required for the yearlings and 168 days for the 2-year-olds as shown by these tests. (For further information see Table 10, page 18.)

D. *Shelled corn, corn silage, and hay* according to feeding tests will produce 475 pounds of gain on steer calves with 42 bushels of shelled corn, 1871 pounds of silage, and 556 pounds of hay. A gain of 375 pounds on the yearling

Table 9. — Feed consumed in fattening calves and yearlings with corn and cob meal, supplement, hay, and corn silage

	Calves[1]	Yearlings[2]
Number of trials	4	24
Weight at beginning, lbs.	415	657
Weight at end, lbs.	953	1082
Gain per head, lbs.	538	425
Days on feed	253	180
Average daily gain, lbs.	2.13	2.36
Feed required per 100 lbs. of gain:		
Corn and cob meal, lbs.	585	585
Supplement, lbs.	82	75
Hay, lbs.	98	92
Corn silage, lbs.	287	569
With an initial weight of — lbs.	400–450	650–700
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	475	375
Feeding period, days	223	159
Then the total amount of feed required per head is:		
Corn and cob meal, bus.	40.8	32.3
Supplement, lbs.	390	281
Hay, lbs.	465	345
Corn silage, lbs.	1363	2133

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 179; Minn. 300.
[2] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 173, 176, 186; Penn. 329.

Table 10. — Feed consumed in fattening calves, yearlings, and 2-year-old steers with supplement, hay, and corn silage in dry lot

	Calves[1]	Yearlings[2]	2-year-olds[3]
Number of trials	4	4	6
Weight at beginning, lbs.	385	690	963
Weight at end, lbs.	622	1056	1223
Gain per head, lbs.	237	366	260
Days on feed	135	170	136
Average daily gain, lbs.	1.76	2.15	1.91
Feed required per 100 lbs. of gain:			
Supplement, lbs.	122	92	144
Hay, lbs.	175	114	216
Corn silage, lbs.	1267	2382	2643
With an initial weight of — lbs.	400–450	650–700	950–1000
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	*	375	320
Feeding period, days	....	174	168
Then the total amount of feed required per head is:			
Supplement, lbs.	....	345	461
Hay, lbs.	....	428	691
Corn silage, lbs.	....	8933	8458

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 117, 123, 129; Kan. Cir. 86.
[2] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 139, 146, 151, 157.
[3] Agr. Exp. Sta. Bul.—Ind. 206, 220, 240, 249, 255, 265.

* It is highly probable that calves cannot be brought to a satisfactory finish on this ration alone because of its bulky nature.

steers, as indicated by tests, will be made on 34 bushels of shelled corn, 3379 pounds of corn silage, and 761 pounds of hay. The 2-year-old steers, according to tests, will consume 39 bushels of shelled corn, 4332 pounds of corn silage, and 595 pounds of hay in making a gain per steer of 320 pounds. An average feeding period of 241 days for the calves, 174 days for the yearlings, and 155 days for the 2-year-olds are indicated as necessary when this ration is used. (For additional information see Table 11, below.)

E. *Shelled corn, supplement, and hay* for fattening steers according to tests made by the various experiment stations and colleges will produce a fairly satisfactory finish in 218 days on calves with 44 bushels of shelled corn, 356 pounds of supplement, and 1002 pounds of hay per animal. Yearling steers consumed

Table 11. — Feed consumed in fattening calves, yearlings, and 2-year-old steers with shelled corn, hay, and silage in dry lot

	Calves[1]	Yearlings[2]	2-year-olds[3]
Number of trials	4	4	10
Weight at beginning, lbs.	404	701	983
Weight at end, lbs.	761	1034	1292
Gain per head, lbs.	357	333	309
Days on feed	181	155	149
Average daily gain, lbs.	1.97	2.15	2.07
Feed required per 100 lbs of gain:			
Shelled corn, lbs.	497	506	684
Hay, lbs.	117	203	186
Corn silage, lbs.	394	901	1354
With an initial weight of — lbs.	400–450	650–700	950–1000
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	475	375	320
Feeding period, days	241	174	155
Then the total amount of feed required per head is:			
Shelled corn, bus.	42.2	33.9	39.1
Hay, lbs.	556	761	595
Corn silage, lbs.	1871	3379	4332

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 117; Minn. 300; Kan. Cir. 105, 117.
[2] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 93-94, 105-106; Ind. 255.
[3] Agr. Exp. Sta. Bul.—Ind. 129, 220, 240, 249, 265, 281, 291, 314 ,396.

approximately the same amount of shelled corn and supplement in these tests as did the calves, but somewhat more hay. The feeding trials indicate that yearlings will require 162 days on feed to make a gain of 375 pounds per steer. Two-year-old steers, the tests show, will consume 39 bushels of shelled corn, 377 pounds of supplement, and 1641 pounds of hay in making a gain of 320 pounds per head, and a feeding period of 136 days will be required for the 2-year-olds. (For additional information see Table 12, page 20.)

F. *Shelled corn and hay* as a fattening ration have been tested at many of our agricultural experiment stations and colleges. To produce a fairly satisfactory finish with this ration will require approximately 50 bushels of shelled corn and 1100 to 1500 pounds of hay per steer. Slightly less feed will be required in the case of calves, and slightly more in the case of 2-year-old steers, as shown by these tests. (For additional information see Table 13, page 20.)

G. *Good legume hay alone* in four trials with 2-year-old steers produced an average daily gain of 1.17 pounds, and to produce 100 pounds of gain, 2790 pounds of hay were required. In one trial in Montana, yearling steers made similar daily gains and produced 100 pounds of gain on 2370 pounds of hay. In two Kansas trials, calves gained 0.6 pound per day and produced 100 pounds

Table 12. — Feed consumed in fattening calves, yearlings, and 2-year-old steers with shelled corn, supplement, and hay in dry lot

	Calves[1]	Yearlings[2]	2-year-olds[3]
Number of trials	7	4	9
Weight at beginning, lbs.	431	652	989
Weight at end, lbs.	905	1100	1335
Gain per head, lbs.	474	448	346
Days on feed	217	193	147
Average daily gain, lbs.	2.18	2.32	2.35
Feed required per 100 lbs of gain:			
Shelled corn, lbs.	517	644	684
Supplement, lbs.	75	96	118
Hay, lbs.	211	359	513
With an initial weight of — lbs.	400–450	650–700	950–1000
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	475	375	320
Feeding period, days	218	162	136
Then the total feed required per head is:			
Shelled corn, bus.	43.8	43.1	39.1
Supplement, lbs.	356	360	377
Hay, lbs.	1002	1346	1641

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 179; Minn. 274, 300; Ind. 136, 146, Iowa 271.
[2] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 139; Ind. 136, 146; Iowa 271.
[3] Agr. Exp. Sta. Bul.—Ind. 136, 163, 183, 191, 206; Iowa 271.

Table 13. — Feed consumed in fattening calves, yearlings, and 2-year-old steers with shelled corn and hay in dry lot

	Calves[1]	Yearlings[2]	2-year-olds[3]
Number of trials	8	9	7
Weight at beginning, lbs.	425	712	1002
Weight at end, lbs.	884	1075	1322
Gain per head, lbs.	459	363	320
Days on feed	200	162	158
Average daily gain, lbs.	2.29	2.23	2.02
Feed required per 100 lbs. of gain:			
Shelled corn, lbs.	542	734	911
Hay, lbs.	247	301	465
With an initial weight of — lbs.	400–450	650–700	950–1000
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	475	375	320
Feeding period, days	207	168	158
Then the total amount of feed required per head is:			
Shelled corn, bus.	46.0	49.2	52.1
Hay, lbs.	1173	1129	1488

[1] Agr. Exp. Sta. Bul.—Minn. 237; So. Dak. 293; Nebr. 252, 295.
[2] Agr. Exp. Sta. Bul.—Nebr. 252; Minn. 274.
[3] Agr. Exp. Sta. Bul.—Ind. 129; Minn. 300; Ill. 103, 328.

Table 14. — Feed consumed by calves, yearlings, and 2-year-old steers fed good legume hay only in dry lot

	Calves[1]	Yearlings[2]	2-year-olds[3]
Number of trials	2	1	4
Weight at beginning, lbs.	440	744	944
Weight at end, lbs.	503	919	1061
Gain per head, lbs.	63	175	117
Days on feed	111	152	100
Average daily gain, lbs.	0.6	1.15	1.17
Feed required per 100 lbs. of gain:			
Legume hay, lbs.	2036	2370	2790

[1] Agr. Exp. Sta. Bul.—Kan. Cir. 86, 92.
[2] Agr. Exp. Sta. Bul.—Mont. 251.
[3] Agr. Exp. Sta. Bul—Wash. 208, Oregon 193, Idaho 209, Arizona 91.

Table 15. — Feed consumed by calves fed legume hay and corn silage

	Calves[1]
Number of trials	5
Weight at beginning, lbs.	379
Weight at end, lbs.	545
Gain per head, lbs.	166
Average daily gain, lbs.	1.36
Days on feed	122
Feed required per 100 lbs. of gain:	
Legume hay, lbs.	532
Corn silage, lbs.	1347

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 117, 123, 129; Mich. Qt. 13, 14.

of gain on 2036 pounds of hay. (See Table 14.)[1]

H. *Corn silage and legume hay* fed to steer calves in several trials conducted at agricultural experiment stations produced an average daily gain of 1.36 pounds. In these trials 532 pounds of legume hay and 1347 pounds of silage produced 100 pounds of gain on the calves. (See Table 15.)

Feed Consumed in the Production of a Fairly Satisfactory Finish on Beef Animals when Fed less than a Full Feed of Corn

Feeding trials in which full feeding of corn has been compared with lighter feeding of corn and heavier feeding of hay to yearling steers have been in progress in Ohio for three years. On the basis of the results of these trials, yearling steers that are fed a full feed of corn will consume 38 bushels of corn in the form of corn and cob meal, 293 pounds of supplement, 2696 pounds of corn silage, and 634 pounds of hay, in gaining 375 pounds per steer; yearling steers that are fed a three-fourths full feed of corn will consume 31 bushels of corn in the form of corn and cob meal, 311 pounds of supplement, 2963 pounds of corn silage, and 1301 pounds of hay in gaining 375 pounds per steer; and yearling steers that are fed a half full feed of corn will consume 22 bushels of corn in the form of corn and cob meal, 330 pounds of supplement, 3161 pounds of corn silage, and 1938 pounds of hay in making a gain of 375 pounds per steer.

Considerably less corn and more hay was consumed by those fed a less than a full feed than by the steers receiving a full feed in producing the same

[1] It is believed that the average daily gain on calves when receiving good hay will average somewhat better than that experienced in these two trials. On page 708 of the 20th edition of Morrison's Feeds and Feeding the following statement appears: "If calves are fed all of the good alfalfa hay they will clean up reasonably well, they will eat 12-20 pounds of hay per day, depending on their size, and will gain approximately 1.0 pound per head daily, or perhaps even more."

gain, but the degree of finish reached and the time required to make this gain varied somewhat. The full fed steers were better finished and in a shorter period than were those that received limited feeds of corn and heavier feeds of hay. (For further information regarding feed requirements, rate of gain, and the like on limited feeding see Table 16 and Ohio Agricultural Experiment Station Bi-Monthly bulletin 198.)

Table 16. — Feed consumed by yearling steers fed a full feed of corn, three-fourths full feed of corn, and one-half full feed of corn, a uniform amount of corn silage, and increasing amounts of hay[1]

	Full feed of corn	¾ full feed of corn	½ full feed of corn
Number of trials	3	3	3
Weight at beginning, lbs.	694	694	686
Weight at end, lbs.	1152	1133	1091
Gain per head, lbs.	458	439	405
Days on feed	240	240	240
Average daily gain, lbs.	1.91	1.78	1.69
Feed required per 100 lbs. of gain:			
Corn and cob meal, lbs.	696	564	399
Supplement, lbs.	78	83	88
Hay, lbs.	169	347	517
Corn silage, lbs.	719	790	843
With an initial weight of — lbs.	650–700	650–700	650–700
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	375	375	375
Feeding period, days	196	211	222
Then the total feed required per head is:			
Corn and cob meal, bus.	38.4	31.1	22.0
Supplement, lbs.	293	311	330
Hay, lbs.	634	1301	1938
Corn silage, lbs.	2696	2963	3161

[1] Data obtained from experiments, the results of which are reported in Ohio Agricultural Experiment Station Bi-Monthly Bulletin 198.

Feed Consumed in Producing a Fairly Satisfactory Finish on Beef Animals when Fed Corn in Various Forms

Yearling steers will consume the equivalent of 47.9 bushels of shelled corn when fed as long shock corn (1.4 acres of corn averaging 34 bushels of corn per acre containing 15 per cent moisture), 457 pounds of supplement, 859 pounds of hay to make a gain of 375 pounds per steer, and a 230-day feeding period will be required according to the results of feeding trials. (See Table 17 for similar data on 2-year-old steers.)

Yearling steers when fed corn silage, supplement, and hay will require the equivalent of 24.5 bushels of shelled corn[1] when fed in form of silage, 345 pounds of supplement, and 428 pounds of hay to make a gain of 375 pounds per steer, and a 174-day feeding period will be required. (See Table 10, page 18.)

Yearling steers when fed shelled corn, supplement, and hay will consume 43.1 bushels of shelled corn, 360 pounds of supplement, and 1346 pounds of hay to make a gain of 375 pounds per steer, and a feeding period of 162 days will be required. (See Table 12, page 20.)

[1] Corn silage was converted into a shelled corn equivalent on the basis of 5.5 bushels of corn to the ton of silage.

Yearling steers receiving shelled corn, corn silage, supplement, and hay will consume the equivalent of 41.4 bushels of shelled corn[1] when the corn is fed both as shelled corn and corn silage, 300 pounds of supplement, and 401 pounds of hay to make a gain of 375 pounds per steer, and a 176-day feeding period will be required for this gain. (See Table 4, page 13.)

Yearling steers receiving corn and cob meal, corn silage, supplement, and hay will consume the equivalent of 38.1 bushels of shelled corn[1] when the corn is fed both as corn and cob meal and silage, 281 pounds of supplement, and 345 pounds of hay to make a gain of 375 pounds, and a 159-day feeding period will be required for this gain. (See Table 9, page 18.)

Two-year-old steers fed broken ear corn, corn silage, supplement, and hay will consume the equivalent of 40 bushels of shelled corn when the corn is fed both as broken ear corn and as corn silage (33.5 bushels of ear corn and 2300 pounds of corn silage), 371 pounds of supplement, and 621 pounds of hay to make a gain of 320 pounds per steer, and a 152-day feeding period will be required. (See Table 17, page 24.)

The form in which the corn is fed to steers materially influences the amount of gain made by hogs following cattle. Where long shock corn is fed, the gain on hogs is usually highest. Ear corn and shell corn follow, with the least gains being made on hogs where the cattle are fed corn meal or corn and cob meal. The gains made by hogs when the cattle are fed corn silage is somewhere between ground corn and shelled corn. (For further information on pork gains see Table 3, pg. 12; Table 6, pg. 15; Table 17, pg. 24; and Table 20, pg. 26.)

Feed Consumed in Producing 100 Pounds of Gain on Beef Animals on Pasture

An average of four tests conducted at the Ohio Agricultural Experiment Station in which heifer calves were fed on shelled corn and pasture, 646 pounds of shelled corn were required per 100 pounds of gain. The average weight of the heifers at the start of the feeding period was 471 pounds. At the end of the 171-day feeding period they weighed 760 pounds each, a gain of 289 pounds.

Steer calves weighing 464 pounds when fed shelled corn, supplement, and pasture for a period of 171 days weighed 768 pounds, a gain of 304 pounds per steer. They consumed 574 pounds of corn and 63 pounds of supplement in addition to pasture per 100 pounds of gain.

Three trials in which yearling steers weighing 639 pounds at the beginning of the feeding period were fed shelled corn and supplement on pasture for 133 days. At the close of the period they weighed 913 pounds, a gain of 274 pounds per head. They consumed 634 pounds of shelled corn and 71 pounds of supplement in addition to pasture per 100 pounds of gain.

Two-year-old steers weighing 1006 pounds at the beginning of a 140-day feeding period at Illinois Agricultural Experiment Station consumed 1029 pounds of shelled corn in addition to pasture per 100 pounds of gain. At the end of the feeding period they weighed 1277 pounds, a gain of 271 pounds each. (See Table 18, page 24.)

[1] Corn silage was converted into a shelled corn equivalent on the basis of 5.5 bushels of corn to the ton of silage.

Table 17. — Feed consumed by yearlings and 2-year-old steers fed long shock corn, and 2-year-old steers fed broken ear corn

	Long shock corn		Broken ear corn
	Yearlings[1]	2-year-olds[2]	2-year-olds[3]
Number of trials	3 lots	27 lots	3 lots
Weight at beginning, lbs.	708	1020	994
Weight at end, lbs.	965	1250	1314
Gain per head, lbs.	257	230	320
Pork gain per steer, lbs.	53	120	57
Days on feed	158	125	152
Average daily gain, lbs.	1.62	1.84	2.10
Feed required per 100 lbs. of gain:			
Shock corn on shelled corn basis, lbs.	715	1269	....
Broken ear corn on shelled corn basis, lbs.	....	....	586
Supplement, lbs.	122	....	116
Hay, lbs.	229	68	194
Stover, lbs.	Some	Some	Some
Corn silage, lbs.	....	....	719
Assuming that the gain required per head to give a fairly satisfactory finish is	375	320	320
Feeding period, days required	230	174	152
Then the total feed required per head is:			
Shock corn on shelled corn basis, bus.	47.9	72.5	....
Broken ear corn on shelled corn basis, bus.	....	....	33.5
Supplement, lbs.	457	....	371
Hay, lbs.	859	218	621
Stover, lbs.	Some	Some	Some
Corn silage, lbs.	....	....	2301

[1] Agr. Exp. Sta.—Mich.Qt., Vols. 16, 17, 18.
[2] U.S.D.A. Technical Bulletin 23. Data obtained from records kept by farmers cooperating with U. S. Dept. Agriculture. Calculated on basis of corn carrying 15 per cent moisture, which is considerably below the percentage of moisture in the corn at time it was fed. Calculated on basis of normal fall moisture condition.
[3] Agr. Exp. Sta. Bul.—Ohio 149; Ill. 103; and Ky. Cir. 26.

Table 18. — Feed consumed in fattening calves, yearlings, and 2-year-old steers with shelled corn and pasture

	Heifer calves[1]	Steer calves[2]	Yearlings[3]	2-year-olds[4]
Number of trials	4	4	3	2
Weight at beginning, lbs.	471	464	639	1006
Weight at end, lbs.	760	768	913	1277
Gain per head, lbs.	289	304	274	271
Days on feed, lbs.	171	171	133	140
Average daily gain, lbs.	1.69	1.78	2.06	1.94
Feed required per 100 lbs. of gain:				
Shelled corn, lbs.	646	574	634	1029
Supplement, lbs.	....	63	71	....
Pasture	Yes	Yes	Yes	Yes

[1] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 173, 179, 186; Nebr. 281.
[2] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 155, 173, 179, 186.
[3] Agr. Exp. Sta. Bul.—Ohio Bi-Mo. 123, 138, 144.
[4] Agr. Exp. Sta. Bul.—Ill. 328.

Many feeders follow the practice of buying feeders in the fall, roughing them through the winter, and finishing them on pasture the following spring and summer. Data on feed consumption and rates of gain for various feeding methods involving pasture, obtained from farm records kept in cooperation with the Department of Agriculture, are given in Table 19, page 25.

Table 19. — Feed consumed by medium-weight cattle when fattened by different systems of feeding[1]

Item	Medium-weight cattle, 751 to 1000 pounds					Medium-weight cattle
	Winter-roughed[2]	Well-wintered[3]				Bought in spring and finished on grass with corn throughout pasture period
	Corn-fed on summer pasture	Finished on grass with little or no other feed	Finished on grass with corn throughout pasture period	Finished on grass with corn and molasses throughout pasture period	Finished on grass, fed heavily last few weeks only	
Number of droves	9	9	27	11	9	11
Number of cattle	474	436	1557	825	875	476
Initial weight per head, lbs.	929	883	872	871	845	905
Gain in weight per head, lbs.	331	299	373	349	339	291
Days on farm	266	263	234	253	309	148
Feed, per head:						
Grain shelled-corn basis, bus.	34	39	44	46	46	49
Protein concentrates, lbs.	...	18	100	2	30	...
Molasses and prepared feeds, lbs.	...	8	12	291	42	...
Legume hay, lbs.	275	478	496	248	244	38
Mixed hay, lbs.	295	466	142	447	227	...
Straw and stover, lbs.	404	840	746	820	1468	128
Silage, lbs.	357	544	612	98	176	55
Pasture, days	202	144	131	133	193	143

[1] Source: U.S.D.A. Technical Bulletin 23.

[2] Cattle winter-roughed, were wintered on corn stalk pasture, hay, and stover.

[3] Cattle well wintered, were fed a liberal quantity of grain in addition to roughages.

Table 20. — Feed consumed in producing 100 pounds of gain on calves, yearling, and 2-year-old steers on farms according to detailed cost of production studies

	Illinois[1]		Michigan[2]
	Yearling steers	2-year-old steers	Calves
Number of lots	12	15	40
Number of steers	399	666	1810
Weight at beginning, lbs.	609	915	510
Weight at end, lbs.	959	1192	966
Gain per head, lbs.	350	277	456
Pork per steer, lbs.	51	75	...
Days on feed	247	178	245
Average daily gain, lbs.	1.4	1.5	1.86
Pasture, days per steer[3]	80	19	...
Feed required per 100 lbs. of gain:			
Shelled corn, lbs.	543	1005	} 616
Oats, lbs.	37	....	
Supplement, lbs.	27	66	
Hay, lbs.	172	221	230
Corn silage, lbs.	806	495	417
With an initial weight of — lbs.	650–700	950–1000	400–450
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	375	320	475
Feeding period, days	264	205	255
Then the total feed required per head is:			
Shelled corn, bus.	36.4	57.4	} 2926
Oats, bus.	4.3	...	
Supplement, lbs.	101	211	
Hay, lbs.	645	707	1100
Corn silage, lbs.	3022	1584	1998
Pasture days	....	....	....

Feed Consumed and Gain on Beef Animals on Farms on which Detailed Records were kept of their Feeding Operations

A group of Illinois farmers[1] who fed yearling steers produced a gain of 350 pounds per steer and 51 pounds of pork per steer on the hogs that followed the cattle. The steers were on feed an average of 247 days and consumed per steer 34 bushels of shelled corn, 4 bushels of oats, 94 pounds of supplement, 602 pounds of hay, 2821 pounds of corn silage, and 80 days of pasture. In the same state the farmers who fed 2-year-old steers produced a gain of 277 pounds per steer and 75 pounds of pork per steer on the hogs that followed the cattle. They were on feed an average of 178 days and consumed per steer 50 bushels of shelled corn, 183 pounds of supplement, 614 pounds of hay, 1374 pounds of corn silage, and 19 days of pasture (only a few of the farmers utilized any pasture, thus the small number of days per steer.)

On a group of Michigan farms[2] where 1810 head of cattle were fed, the average weight at the start of the feeding period was 510 pounds and at the end of 245 days 966 pounds, a gain of 456 pounds per head. The average amount of feed consumed per head by the cattle during the feeding period was 2809 pounds of concentrates, 1056 pounds of hay, and 1918 pounds of corn silage. In a few cases, some pasture was added. (See Table 20, above.)

[1] Source of data: Illinois Agricultural Experiment Station Bul. 261.
[2] Source of data: Quarterly Bulletin, Vol. 20, No. 4, Michigan Agricultural Experiment Station Bulletin.
[3] On some farms the cattle had access to pasture during all or part of the feeding period.

Table 21. — Summary of the quantity of feed that will be consumed in the production of a fairly satisfactory finish on beef animals of different ages and types when fed different types of rations, based on the results of feeding trials conducted at agricultural experiment stations and colleges

Age and Type of Beef Animal	Total gain per head—lbs.	Days required to produce gain	Quantity of feed required to produce a fairly satisfactory finish[1]			
			Corn bus.	Supplement lbs.	Corn silage lbs.	Hay lbs.
Steer calves	475	207	46 shelled	...	....	1173
Yearling steers	375	168	49 shelled	...	....	1129
Two-year-old steers	320	158	52 shelled	...	....	1488
Steer calves	475	218	44 shelled	356	....	1002
Yearling steers	375	162	43 shelled	360	....	1346
Two-year-old steers	320	136	39 shelled	377	....	1641
Steer calves	475	228	38 shelled	347	2042	470
Yearling steers	375	176	34 shelled	300	2677	401
Two-year-old steers	320	131	31 shelled	333	3686	419
Yearling steers	375	174	.....	345	8933	428
Two-year-old steers	320	168	.....	461	8458	691
Steer calves	475	241	42 shelled	...	1871	556
Yearling steers	375	174	34 shelled	...	3379	761
Two-year-old steers	320	155	39 shelled	...	4332	595
Steer calves	475	223	41 corn and cob meal	390	1363	465
Yearling steers	375	159	32 corn and cob meal	281	2133	345
Good quality yearling steers	375	164	33 corn and cob meal	296	2062	326
Medium quality yearling steers	375	158	32 corn and cob meal	285	2013	326
Common quality yearling steers	375	156	32 corn and cob meal	281	2010	322
Yearling steers (full fed corn)	375	196	38 corn and cob meal	293	2696	634
Yearling steers (¾ full fed corn)	375	211	31 corn and cob meal	311	2963	1301
Yearling steers (½ full fed corn)	375	222	22 corn and cob meal	330	3161	1938
Heifer calves	350	153	27 shelled	269	1277	294

[1] The gain considered necessary to produce a fairly satisfactory finish with an initial weight of: Steer calves, 400-450 lbs., is 475 lbs.; Yearling steers, 650-700 lbs., is 375 lbs.; Two-year-old steers, 950-1000 lbs., is 320 lbs.; Heifer calves, 400-450 lbs., is 350 lbs.

Part II — The Dairy Enterprise

◆

Contents

◆

List of Tables

☞ All data on the quantity of grain and hay consumed or required annually or for a given amount of production in this bulletin are on a dry weight basis, unless otherwise stated. Thus an adjustment for normal shrinkage due to loss of moisture after storing must be made for corn and hay before calculating the amount of livestock that these feeds will support. (See text, page 6, for information on the determination of the quantity of farm-produced feeds available for feeding.)

The Dairy Enterprise

THE QUANTITY of feed fed annually to a cow under actual farm conditions varies greatly. The lower limit to quantity is that which is just sufficient to keep the cow alive, and the upper extreme is what may almost be considered forced feeding of all of the best and most palatable feeds that a cow will consume. Neither extreme exists in many cases. However, during some periods of feed shortage, which is a rather common occurrence on a few farms, cows may not receive enough feed to maintain them in good condition. On some farms and in a few institutions, the cows are encouraged to consume the maximum of feed, to produce the greatest possible amount of milk and butterfat. In the latter case, the feed consumed per cow over a period of a year may be as much as three times as great as in the former (pasture excluded).

It is somewhere between these two extremes that most cows are fed. On the majority of farms, the tendency is to supply as nearly as possible all of the feed that the cow will consume readily, but often a large part of this is made up of rough feeds such as low-grade legume hay, timothy, and corn stover, which are low in feeding value. On other farms, the quantity of feed fed per animal may be about the same, but of higher quality.

Milk and butterfat are the principal products sought in feeding the dairy cow, and it is in terms of their production that the results of feeding are measured. Not only does the output tend to vary with the quantity of feed consumed per dairy cow, but with the quality of the feed fed, the care given the cow, and the inherited ability of the cow to convert the feed consumed into milk and butterfat. The latter factor is significant in that the same quantity of feed that is fed to a cow producing 10,000 pounds of milk containing 400 pounds of butterfat, when fed to another cow may result in but two-thirds as much milk and butterfat.

It is evident that each farm operator, in estimating the number of cows his farm will normally provide feed for — or, if he plans to keep a given number of cows, how much feed will be needed — must take into account both his feed supply (quantity and quality) and the productive capacity of his cows. If the latter is 5000 pounds per head, he should not estimate his feed requirements on the basis of cows producing 10,000 pounds; nor, if his cows are capable of producing 10,000 pounds of milk each, should he estimate his feed on the basis of the feed requirements of 5000-pound cows. Likewise, if his roughages are of low quality, he may find it advisable to increase the quantity of concentrate and the protein in the concentrates. On the other hand, if he has a liberal amount of high quality legume roughage to feed, a little less concentrated feed containing less protein may suffice.

The breed of cows on the farm must be taken into the calculation, as the larger cows such as Holsteins have capacity to consume more feed than smaller cows such as Jerseys and Guernseys.

Records kept on the feed consumption and production per cow in farm dairy herds provide the major source of information useful as a guide to the quantity of feed consumed annually per cow. These records are predominantly

of two types, those kept in connection with Dairy Herd Improvement Associations, and those collected in detailed cost account studies. In addition to these sources, the results of feeding trials and experimental work conducted at the various agricultural experiment stations and colleges serve as guides. The latter source, due to the fact that many of the experiments have been conducted during a few months only, and not over a full year, offer little assistance as a guide to quantities of feed required during a full year. Likewise, the very high productive capacity of many of the cows that are often used in experimental work tends to limit the use of the data obtained on the quantity and quality of feed consumed, to cows with similar productive capacity.

Feed Consumed Annually per Cow as Indicated by Dairy Herd Improvement Association Records

In 1932-1933 the Ohio Dairy Herd Improvement Records on 4694 cows were summarized according to their production of butterfat, by the Animal Husbandry Department. (See Table 22, below.)[1]

The average quantity of roughage consumed per cow, according to this summary, was almost the same regardless of the butterfat production. It was approximately 5500 pounds of corn silage, 2500 pounds of hay, 300 to 400 pounds of corn stover, and 140 to 150 days on pasture per cow. The quality of these feeds is not known, but it is reasonable to expect that there was considerable variation, particularly in the quality and composition of the hay and the quality of the pasture. The variation in quality of the roughage may in part account for the fact that some cows produced more butterfat on the same weight of roughage than did other cows.

The average amount of concentrates fed per cow was least for the low producing group and greatest for the high producing group. The quality or the composition of the concentrates fed, like that of the roughage, is not known, but it is reasonable to expect that the composition of the concentrate was such that the rations were probably better balanced in those groups where butterfat production was highest.

Table 22. — Feed consumed annually per cow according to Ohio dairy herd improvement association records (1932-1933)

No of cows	Group range lbs. butterfat	Average annual production per cow, lbs		Annual feed consumption per cow, lbs			
		Butterfat	Milk	Silage	Hay	Stover	Concentrates
267	Under 200	164	4048	5100	2500	360	1660
505	200 to 249	228	5600	5400	2280	350	2040
948	250 to 299	276	6664	5300	2300	420	2180
1109	300 to 349	324	7761	5400	2560	390	2660
893	350 to 399	372	8626	5500	2410	350	2920
972	400 and over	455	10101	5500	2460	270	3370

[1] In summarizing, no distinction was made as to breed or whether both hay and silage or only hay was fed, however, most cows were fed both

Dairy herd improvement association records in Michigan, similar to those in Ohio, have been summarized.[1] These records were divided into two groups according to breed of the cows, the one group being predominantly Holsteins and the other Jerseys and Guernseys. These groups were further divided into two groups, those receiving silage and those receiving no silage.

According to the analysis of Michigan Dairy Herd Improvement Association records, the average annual roughage consumption in addition to pasture for the smaller breeds (Jerseys and Guernseys) was corn silage, 5000 to 5500 pounds; and dry roughage, 2500 to 3000 pounds per cow. The average annual milk production of this group was 6895 pounds per cow and the total concentrates fed per cow was 2213 pounds. On farms where no silage was available, the lighter breeds consumed 4000 to 4500 pounds of dry roughage per cow. The average annual milk production for this group was 6422 pounds per cow.

The average annual roughage consumption in addition to pasture by the heavier breeds (predominantly Holsteins) when both silage and other dry roughage was fed was from about 5500 to 6500 pounds of corn silage and from about 3000 to 3500 pounds of dry roughage per cow. When no silage was fed the dry roughage consumed per cow averaged 4600 to 5300 pounds. Where both silage and hay were fed the heavier breeds produced 9136 pounds of milk per cow and when only dry roughage was available they produced 7796 pounds. (For information on the quantities of feed fed at different levels of production, see Tables 23 to 26, pages 33 and 34.)

Feed Consumed Annually per Cow when Cows are Fed Generous Amounts of a Good Quality Hay and Reduced Amounts of Corn Silage and Concentrates

The Ohio Agricultural Experiment Station at the Trumbull County Experiment Farm has, since 1933, been feeding the dairy herd larger quantities of good hay and smaller amounts of silage. In 1932-1933 the 11 cows (purebred and high grade Holstein) were fed during a 320-day lactation period (before modifying the feeding system) approximately 8000 to 8500 pounds of silage, 2000 to 2500 pounds of hay, and 3000 to 3500 pounds of concentrates per cow in addition to summer pasture. The roughage was fed at the rate of about 40 pounds of silage and 10 pounds of hay per day during the winter season. On this system of feeding the cows averaged a little over 10,000 pounds of milk per cow per year.

In 1933-1934 the same cows were shifted to a system of less silage and more hay. During the winter feeding, the average daily ration was about 20 pounds of good legume hay and 30 pounds of silage. For the entire lactation period (320 days) the average annual consumption of good quality hay per cow was 4000 to 4500 pounds and silage was 6000 to 6500 pounds.

Under the heavier hay feeding system the cows were divided into two lots; one group received concentrates at the same rate as under the old system of heavy silage light hay, and the other group received a somewhat lighter feed

[1] An individual feed record was not used unless the cow was in the association 12 months, produced milk for at least 10 months of that period, and was on pasture 90 days or more during the year. The cows averaged approximately 160 days on pasture per year.

Table 23.—Feed consumed annually per Holstein cow when silage makes up part of the ration according to Dairy Herd Improvement Association Records in southern Michigan, 1927-1930[1]

No. of cows	Group range	Average production per cow, lbs.		Silage lbs.	Dry roughage lbs.	Concentrates lbs.
		Milk	Butterfat			
102.....	3501 to 5000.....	4420	166	5646	2916	1501
164.....	5001 to 6500.....	5843	211	5731	3344	1765
176.....	6501 to 8000.....	7358	262	5981	3125	1944
178.....	8001 to 9500.....	8740	308	6092	3054	2213
188.....	9501 to 11000.....	10180	348	6470	3087	2041
180.....	11001 to 12500.....	11720	393	6702	3234	2946
190.....	12501 to 14000.....	13145	443	6452	3480	3556

[1] Data obtained from Michigan Agricultural Experiment Station Special Bulletin 250.

Table 24. — Feed consumed annually per Holstein cow when little or no succulent roughages were included in the ration according to Dairy Herd Improvement Association Records in Michigan, 1927-1930[1]

No. of cows	Group range	Average production per cow, lbs.		Silage lbs.	Dry roughage lbs.	Concentrates lbs.
		Milk	Butterfat			
69.....	3501 to 5000.....	4379	168	....	4606	878
148.....	5001 to 6500.....	5812	218	....	4694	1156
131.....	6501 to 8000.....	7282	274	....	4644	1424
105.....	8001 to 9500.....	8663	310	....	4896	1710
89.....	9501 to 11000.....	10111	348	....	5325	2016
78.....	11001 to 12500.....	11639	398	....	5335	2505

[1] Data obtained from Michigan Agricultural Experiment Station Special Bulletin 250.

Table 25. — Feed consumed annually per Jersey or Guernsey cow when silage makes up part of the ration according to Dairy Herd Improvement Association Records in southern Michigan, 1927-1930[1]

No. of cows	Group range	Average production per cow, lbs.		Silage lbs.	Dry roughage lbs.	Concentrates lbs.
		Milk	Butterfat			
141	3001 to 4000	3596	186	4905	2652	1476
166	4001 to 5000	4566	239	5147	2573	1733
174	5001 to 6000	5561	288	5031	2473	1866
184	6001 to 7000	6514	327	5495	2538	2137
180	7001 to 8000	7494	368	5349	2693	2321
178	8001 to 9000	8447	410	5717	2544	2574
169	9001 to 10000	9404	442	5276	2644	2788
99	10001 to 11000	10394	489	5434	2704	2999

[1] Data obtained from Michigan Agricultural Experiment Station Special Bulletin 250.

Table 26. — Feed consumed annually per Jersey or Guernsey cow when little or no succulent roughages were included in the ration according to Dairy Herd Improvement Association Records in Michigan 1927-1930[1]

No. of cows	Group range	Average production per cow, lbs.		Silage lbs.	Dry roughage lbs.	Concentrates lbs.
		Milk	Butterfat			
66	3001 to 4000	3621	187	....	4028	1073
120	4001 to 5000	4586	245	. ..	4208	1331
107	5001 to 6000	5529	275	....	4416	1541
92	6001 to 7000	6591	322	....	4378	1561
89	7001 to 8000	7448	359	....	4373	1852
93	8001 to 9000	8436	397	. ..	4300	2080
70	9001 to 10000	9382	421	....	4330	2468

[1] Data obtained from Michigan Agricultural Experiment Station Special Bulletin 250.

Table 27. — Feed consumed during a 320-day lactation period, before and after increasing the amount of hay fed, but without any change in the amount of concentrates fed[1]

	Light hay, heavy silage	Moderate hay, moderate silage
Number of cows in test	5	5
Production:		
Milk, lbs.	9,486.8	10,655.9
Butterfat, lbs.	321.86	349.94
Fat test, pct.	3.39	3.28
Feed Consumption:		
Grain, lbs.[2]	2,853	2,838
Hay, lbs.[3]	2,219	4,154
Silage, lbs.	8,222	6,165
Pasture[4]	....	....

[1] Source: Ohio Agricultural Experiment Station Bulletin 538. The experiment was conducted at the Trumbull County Experiment Farm. The same cows were used in each of these tests.

[2] The grain mixture used consisted of the following: Corn and cob meal, 500 lbs.; oats, 300 lbs.; bran, 100 lbs.; soybean oil meal, 100 lbs.; cottonseed meal, 100 lbs.; salt, 11 lbs. (Digestible crude protein contained in above concentrate mixture — 13.2 per cent.)

[3] Three types of hay were fed: A, mixed hay composed of alfalfa and timothy of the first cutting; B, second cutting alfalfa, which contained some second growth timothy; and C, mixed alsike and medium red clover. The latter comprised only a small part of the hay fed. All hays were made under typical farm conditions.

[4] Both lactation periods the cows received practically the same amount of pasture.

of concentrates. Those cows fed the lighter feed of concentrates produced a little less milk than they did under the old system, but those receiving the same amount of concentrates, more hay, and less silage produced slightly more milk. (See Table 27, above.)

In May 1938, the dairy herd at the Trumbull County Experiment Farm was started on a system of feeding that further reduced the silage and increased the quantity of good hay fed. Under this new plan the maximum daily feed of silage (either corn or grass silage) was limited to 20 pounds per cow, the aim being to provide the cows with all of the good pasture they can consume in the summer and all the early cut, high quality hay they will eat in the winter.

Table 28. — Feed consumed annually per Holstein cow at the Trumbull County (Ohio) Experiment Farm in 1938 when managed under a system of heavy hay, light silage feeding[1]

	Uniform system of roughage and pasture[2]	
	Medium grain feeding	Light grain feeding
Number of cows	5	5
Average production per cow, lbs.	11,110	11,070
Total concentrates per cow, lbs.	2,843	2,258
Corn and oats, lbs.	2,177	1,738
Bran, lbs.	289	221
Oil meal, lbs.	377	299
Silage, lbs. (estimated)[3]	4,000	4,000
Hay, lbs. (estimated)[4]	5,600	6,600

[1] Source: Mimeograph data released by the Trumbull County Experiment Farm.

[2] The cows during a 200-day winter feeding period were fed 20 lbs. of grass silage per cow per day, and all of the good hay that they would consume. During the summer feeding period the cows had access to an abundance of good pasture.

[3] Calculated on basis of 20 lbs. per day for 200 days.

[4] Estimated on the basis of 28 lbs. of hay per day for the cows receiving medium amount of grain, and 33 lbs. for those receiving a light amount of grain.

During 1938, the average consumption per cow was approximately 3 tons of hay and 2 tons of silage along with the pasture and concentrates. (See Table 28, page 35.)

Feed Consumed Annually per Cow as Indicated by Cost Account Records Kept on Dairy Farms

In most of the important dairy states, detailed cost records have been obtained on representative dairy farms. The average amount fed annually per cow on 1269 farms scattered over several central and northeastern states was 1867 pounds of concentrates, 3752 pounds of dry roughage, principally hay, and 5878 pounds of silage, in addition to the summer pasture.

Table 29. — Feed consumed annually per cow (predominantly of the Holstein breed) on 1269 dairy farms on which cost data were obtained[1]

	Per cow
Milk production, lbs.	6272
Grain and concentrates, lbs.	1867
Hay and other dry roughage, lbs.[2]	3752
Succulent roughage, lbs.[3]	5878

[1] Agr. Exp. Sta. Bul.—Ohio 424; U.S.D.A. 858 (Ind.); U.S.D.A. 972 (Nebr.); Iowa 197; Wis. Research Bul. 83; W. Va. 268; New York 409, 414, 421, 432, 438, 442, 554, 641; Mich. 277; Rhode Island 241.

[2] In several of the studies hay was the only dry roughage fed while in most of the others small amounts of other roughages such as corn stover were also fed.

[3] Corn silage constituted 90% or more of the succulent roughage consumed.

The cows in these herds were predominantly of the Holstein breed, and their average annual milk production per cow was 6272 lbs. (See Table 29, at left.)

Cost records (1920-1925) show that Ohio herds of similar breeding with an average annual production of 6656 pounds of milk per cow were fed per year 1921 pounds of concentrates, 2005 pounds of hay, 815 pounds of corn stover, and 9979 pounds of corn silage in addition to summer pasture. (See Table 30.)

Table 30. — Feed consumed annually per cow on a group of dairy farms in Medina County, Ohio, 1920-1925[1]

	Under 6000 lbs. of milk	6000 to 7500 lbs. of milk	7500 to 9000 lbs. of milk	Over 9000 lbs. of milk
Number of farm records	15	17	21	17
Average production per cow	5289	6656	8206	9765
Concentrates per cow:				
Corn, lbs.	789	612	617	914
Oats, lbs.	530	571	568	922
Cottonseed and oilmeal, lbs.	243	263	457	610
Bran and middlings, lbs.	163	117	259	247
Other concentrates, lbs.	291	358	593	431
Total concentrates, lbs.	2016	1921	2494	3124
Roughage per cow:				
Succulent feed, lbs.	7237	9979	9247	8139
Hay, lbs.	2019	2005	2678	2827
Stover, lbs.	729	815	730	1121

[1] Ohio Agricultural Experiment Station Bulletin 424. The dairy herds on these farms were largely made up of cows of the Holstein breed.

Feed Consumed Annually per Cow on Farms Where Dairying is Not Considered a Major Enterprise

On many farms in Ohio a type of farming is conducted in which the emphasis is placed on other enterprises than dairying. However, a dairy unit is maintained on nearly every farm in Ohio, but on those farms on which dairying is not a major enterprise the dairy unit is often small and kept primarily to produce dairy products for home consumption, with the surplus production generally being sold as cream. On many of these farms the cows are of mixed breeding, frequently beefy in type, and the calves are sometimes raised and sold for beef.

According to cost account records kept on farms in a southwestern Ohio county in an area where the common type of farming followed does not place particular emphasis on dairying but rather on hogs, the feed fed annually per milk cow consisted on the average of 1537 pounds of corn and cob meal, 400 pounds of oats, 233 pounds of other concentrated feeds, 1025 pounds of hay, and 3680 pounds of corn stover, in addition to summer pasture. On a few farms some corn silage was fed. The average number of milk cows kept on these farms was 6 head and their annual milk production per cow was 5000 pounds. (See Table 31, Part A, page 38.)

In a northwestern Ohio county where the type of farming was predominantly general and where a fairly large tonnage of alfalfa and other legume hays were produced each year, cost records were kept on a group of farms. On these farms the feed fed annually per milk cow consisted of 985 pounds of corn and cob meal, 592 pounds of oats, 265 pounds of barley and other grains, 138 pounds of other concentrated feeds, 2099 pounds of hay, and 2589 pounds of corn stover, in addition to summer pasture. On a few of the farms some corn silage was fed. There were 4.7 milk cows per farm on these farms, and their average annual milk production was 5600 pounds per cow. (See Table 31, part B, page 38.)

On some farms on which other enterprises than dairying constitute the major sources of income, the dairy often receives better than average attention. Cows of better than average production are kept, well balanced rations are fed, and generally approved dairy management practices are followed. For such farms the quantity of feed fed annually will be similar to that fed on a typical dairy farm.

Feed Consumed by a Dairy Heifer from Birth to Calving (24 to 27 months of age)

Farmers follow numerous systems of raising dairy heifers. On some farms, only a very small amount of liquid milk and concentrated feeds are fed. The bulk of the feed consumed the year before calving is pasture and roughages such as silage, hay, and corn stover. Under such a system, animals develop more slowly than where a more liberal system of feeding is followed. On other farms, larger quantities of whole and skim milk, concentrates, and better quality

Table 31. — Feed consumed annually per milk cow on farms where dairying is not considered a major enterprise

PART A — Southwestern Ohio farms[1] — The commonly used ration consisting primarily of home grown grains, a small amount of hay, and a maximum amount of corn stover.

Average number of milk cows per herd	6
Average annual milk production per cow, lbs.	5000
Concentrates per cow:	
Corn and cob meal, lbs.	1537 (22.6 bu.)
Oats, lbs.	400 (12.5 bu.)
Other feeds, lbs.	233
Total concentrates, lbs.	2170
Roughages per cow:	
Hay, lbs.	1025
Corn stover, lbs.	3680
Total roughage,[2] lbs.	4705
Pasture (5½ to 6 months)	

PART B — Northwestern Ohio farms[3] — The commonly used ration consisting primarily of home grown grains and approximately equal amount of hay and corn stover.

Average number of milk cows per herd	4.7
Average annual milk production per cow, lbs.	5600
Concentrates:	
Corn and cob meal, lbs.	985 (14.5 bu.)
Oats, lbs.	592 (18.5 bu.)
Barley and other grains, lbs.	265
Other feeds, lbs.	138
Total concentrates, lbs.	1980
Roughages:	
Hay, lbs.	2099
Corn stover, lbs.	2589
Total roughage,[4] lbs.	4688
Pasture (5½ to 6 months)	

PART C — On farms where dairying is not a major enterprise but where good cows are kept and recognized dairy practices are used, the feed fed annually is similar to that fed on more typical dairy farms.

[1] Agr. Exp. Sta. Bul.—Ohio 419.
[2] Corn silage was fed on two farms out of seventeen.
[3] Agr. Exp. Sta. Bul.—Ohio 495.
[4] Corn silage was fed on only a few farms and the average for all the cows in the study was 1025 pounds of silage per cow.

roughages are fed, with the result that animals develop more rapidly and frequently better developed individuals are produced. The average amount of feed consumed per dairy heifer from birth to calving, on a large number of dairy farms on which cost account records were kept, was approximately 85 gallons of whole milk, 75 gallons of skim milk, 550 to 600

Table 32. — Feed consumed by a dairy heifer from birth to calving (24 to 27 months of age)[1]

	Per head
Whole milk, lbs.	713
Skim milk, lbs.	624
Grain and concentrate, lbs.	565
Hay, lbs.	3325
Corn silage, lbs.	3215
Stover	Some
Pasture during the normal pasture season.	

[1] Agr. Exp. Sta. Bul.—Ohio 495; New York 421, 438, 442, 452; Oregon 324.

pounds of concentrates, 3000 to 3500 pounds of hay, 3000 to 3500 pounds of silage, some corn stover, and pasture during the pasture seasons. (See Table 32, page 38.)

Feed Consumed Annually by the Dairy Herd Bull. (Bull usually separately confined)

The quantity of feed consumed by a bull varies from farm to farm, depending on the size and breed of the animal and whether or not he is confined to a dry lot the year round. The average feed consumption of many herd bulls on farms on which cost account records were kept was 842 pounds of concentrates, 4000 to 4500 pounds of hay and other dry roughage, 3500 to 4000 pounds of silage, and approximately 50 days of pasture per year. (See Table 33.) Where a larger than average bull is kept additional feed will be necessary. Likewise if the bull is confined to a dry lot during the pasture season more roughage than the average will be needed.

Table 33. — Feed consumed annually by the dairy herd bull[1]

	Per head
Grain and concentrate, lbs.	842
Hay and other roughages, lbs.	4262
Corn silage, lbs.	3696
Pasture, days[2]	....

[1] Agr. Exp. Sta. Bul.—Ohio 419, 424, 495; U.S.D.A. 858 (Ind.); U.S.D.A. 972 (Nebr.); Wis. Research Bul. 83; New York 414, 421, 438.

[2] Many of the bulls on which records were obtained were confined to a dry lot all or most of the time. The average time on pasture per year per bull was approximately 50 days.

Feed Consumed Annually per Bull on Farms Where Dairying is Not a Major Enterprise. (Bull usually not separately confined)

The feed consumed annually per bull on farms where dairying is not a major enterprise and where the bull is not separately confined averaged approximately 10 bushels of grain, ½ ton of hay, and 2 tons of corn stover in addition to pasture during the normal pasture season.[1]

Computed Annual Feed Requirements per Cow Based on common rule-of-thumb Feeding Recommendations

A. *Roughage requirements.*—It is generally recommended by experienced dairy men and investigators that a cow should be fed all the roughage she wants. On most farms cows have access to pasture during the normal pasture season (5 to 6 months). When the pasture is of poor quality or short or both, additional roughages or more grain or both may need to be supplied. In either event the quantity consumed per cow varies much more with the size of the cow than with the milk production per cow. The kind and abundance of pasturage will, naturally, affect the quantity of milk produced.

The roughage fed on most dairy farms during the winter season consists of hay, silage, and some corn stover. Not all farms are equipped with silos, consequently their winter roughage is almost entirely made up of hay and corn stover. The quantities of roughage consumed during the normal winter feeding period (6 to 7 months) vary much more with the size of the cow than with

[1] Ohio Agricultural Experiment Station Bulletin 419.

the milk production. But as in the case of the pasture, the same amount of roughage of different quality will produce different amounts of milk.

The quality of the roughage and pasture will affect the amount that the individual cow will consume. Good bright green hays free from undesirable weeds, etc., and fresh, clean, tender pasture grasses stimulate the cow's appetite and thus increase the amount that she will consume. On the other hand, low quality hays and pasture, though abundant in amount, will be consumed in smaller quantities than will good hay or pasture. If the amount of roughage or pasture consumed is less than normal, due to the low quality or to the limited amount available, it will be necessary to increase the quantity of concentrates fed if production is to be maintained.

Inasmuch as dairy feeding experiments and Dairy Herd Improvement Association records indicate that the pounds of roughages consumed annually per cow is fairly uniform for different levels of milk production, one should take into account, in estimating the amount of pasture, silage, hay, stover, etc., required per year, the size of his cows and the quality or palatability of his roughage and pasture. The average Holstein cow consumed annually 20 per cent more corn silage and hay than the average Jersey and Guernsey, according to the summary of the Michigan Dairy Herd Improvement Association records.

If cows are fed silage liberally, less hay and other dry roughages will be consumed as a result of the limited physical capacity of the cow to consume feed. On some farms where silage is available but less abundant, and less is fed per cow, larger quantities of hay and other dry roughages will be consumed. Some dairy farms have no silos and the winter roughage is in most cases entirely comprised of hay and corn stover. Where this is true, many more pounds of dry roughage are consumed per cow than on farms where silage is available.

The approximate quantity of silage, hay, and other dry roughages that will normally be consumed by cows of different sizes when silage is fed liberally is shown in Table 34, below. If the hay and other dry roughages are of good quality and the cows are fed all they will consume in addition to the silage, the maximum amount of dry roughage listed for each weight of cow will more nearly approximate the amount that will be consumed. On the other hand, if the dry roughages are below average in quality, or if good but the amount fed is somewhat restricted, the minimum amount of dry roughage listed for each weight of cow will more nearly approximate the amount that will be consumed.

Table 34. — Hay and other dry roughage consumption when fed in addition to a liberal feed of silage computed for different weights of cows

Weight of individual cow, lbs.	Consumption per cow during a 200-day winter feeding period, lbs.	
	Liberal feed of silage	Dry roughage fed in addition to silage
700	4200	1400 to 1750
800	4800	1600 to 2000
900	5400	1800 to 2250
1000	6000	2000 to 2500
1100	6600	2200 to 2750
1200	7200	2400 to 3000
1300	7800	2600 to 3250
1400	8400	2800 to 3500
1500	9000	3000 to 3750

The approximate quantity of silage, hay, and other dry roughages that will normally be consumed by cows of different weights when only moderate amounts of silage are fed is given in Table 35, below. When no silage is fed, the approximate amount of dry roughages that will normally be consumed is shown in Table 36, below. It should be kept in mind that the maximum quantity of dry roughage listed for the various sizes of cows will probably not be consumed unless the roughage is of good quality and fed generously.

Table 35. — Hay and other dry roughage consumption when fed in addition to a moderate feed of silage, computed for different weights of cows

Weight of individual cow, lbs.	Consumption per cow during a 200-day winter feeding period, lbs.	
	Moderate feed of silage	Dry roughage fed in addition to silage
700	2800	1750 to 2100
800	3200	2000 to 2400
900	3600	2250 to 2700
1000	4000	2500 to 3000
1100	4400	2750 to 3300
1200	4800	3000 to 3600
1300	5200	3250 to 3900
1400	5600	3500 to 4200
1500	6000	3750 to 4500

Table 36. — Hay and other dry roughage consumption under limited, average, and liberal feeding when no silage is fed, computed for different weights of cows

Weight of individual cow, lbs.	Dry roughage consumption per cow during a 200-day winter feeding period, lbs.		
	Limited feeding	Average feeding	Liberal feeding
700	2100	2600	3150
800	2400	3000	3600
900	2700	3400	4050
1000	3000	3800	4500
1100	3300	4150	4950
1200	3600	4500	5400
1300	3900	4900	5850
1400	4200	5300	6300
1500	4500	5650	6750

B. *Concentrate Requirements.*—In feeding experiments and on better managed dairy farms, the amount of concentrate fed per cow is based on the milk production of the individual cow. A cow producing a large amount of milk would normally receive more concentrates than the same size cow producing a small amount of milk. Production of milk and butterfat, rather than the size of the cow, generally determines the amount of concentrate fed.

The composition of the concentrate fed, if the grain and roughage ration is to be fairly well balanced, must take into account the type and qualities of roughages, including pasture that the cow will have access to. In general, legume hays contain more protein than the mixed hays, straight grass hays, and corn stover. Not only does the protein content and general feeding value vary with the kind of hay, but also with the quality of each kind. Hay that has been rained on (very much) or over-exposed to the sun after it has been cut will

be of a lower grade than hay of a similar kind that has been properly made and has a bright green color when stored in the mow.

The stage of growth at which the plant is cut for hay, likewise, influences the feeding quality. Alfalfa and clovers cut in the early bloom stage and timothy cut immediately before bloom usually carry the maximum amount of protein per acre, and, as the plants near maturity, the amount of protein declines rather rapidly. The feeding quality of hay, in addition to varying with kind, how and when made, will fluctuate from year to year due to uncontrollable climatic conditions.

In planning the content and quantity of concentrates required annually per cow, the content of the concentrate ration must be such that, when added to the roughage fed, will give a balanced ration. The poorer the type or quality (low protein) of roughage fed, the greater will be the amount of protein (high cost feed) that will need to be included in the grain ration to bring it into balance. The better the quality of roughage (high protein) the smaller the amount of high protein concentrate feeds needed in the grain ration to bring it into balance.

The approximate amount of concentrates required per year for various levels of milk production and some suggestions as to the content of the concentrate feed that will give a fairly well balanced ration when fed in combination with different qualities of roughages are given in Table 37, page 43. The quantity of concentrates is based on the common rule of thumb feeding recommendation of 1 pound of concentrates of the proper protein content for each 3 pounds of milk produced by cows of the high testing breeds, and 1 pound of grain for each 4 pounds of milk produced by the low testing breeds.

The number of pounds of concentrates suggested per year per cow for cows producing 5500 to 6000 pounds of 4 to 5 percent milk or 7000 to 7500 pounds of 3 to 3.5 percent milk, is approximately the same for the different types of roughages, but varies in the amount of protein contained in each. The protein content is lowest for the high quality roughages and highest in the case of ordinary timothy and stover. The rations suggested may be modified to fit individual circumstances and variations in feed prices as long as the proper protein content, bulk, palatability, etc., of the concentrated feed is maintained. (For additional suggestions see Agricultural Extension Bulletin 72.)

The above suggestions as to the amount of concentrate required are based on the assumption that the cow is consuming all of the roughage or pasture that she will normally eat and that the quantity consumed is not restricted by the poor quality of the roughage or pasture. If the consumption of roughages or pasture is limited, due either to amount available or to poor quality, the amount of concentrates listed in Table 37, page 43, will not be adequate in most cases to produce the pounds of milk suggested, and, if production is to be maintained, more concentrates will be required.

In the case of very high producing cows that are being fed for maximum milk production, the amount of roughages fed will frequently be reduced somewhat below the average as a result of the heavy feeding of concentrates, which is necessary in order that a sufficient amount of digestible nutrients be supplied to the cow to enable her to produce the large amount of milk and at the same time maintain her body weight.

Table 37. — The approximate amount of various concentrates needed annually per cow for various kinds and qualities of hay when cows are full fed roughages, with or without silage, and with ample summer pasture

Kind of feed	Kind and Quality of Dry Roughage									
	Good alfalfa, *or* mixed with less than 50% grass, *or* good soybean hay		Average alfalfa, *or* mixed with 50% grass, *or* good quality clover, *or* soybean hay		Good mixed 50% clover and 50% timothy hay		Excellent timothy hay with light mixture of legumes		Ordinary timothy hay, and corn stover	
Approximate amount of digestible protein needed in concentrate ration(1):	7.5%		10.5%		13.0%		15.0%		17.0%	
A — For Cows Producing Annually 5500 to 6000 lbs. of 4 to 5 per cent Milk or 7000 to 7500 lbs. of 3 to 3.5 per cent Milk:										
	pounds	*(bu.)*	*pounds*	*(bu.)*	*pounds*	*(bu.)*	*pounds*	*(bu.)*	*pounds*	*(bu.)*
Corn and cob meal	1250	(18.4)	1050	(15.4)	925	(13.6)	850	(12.5)	800	(11.8)
Oats (2)	550	(17.2)	550	(17.2)	475	(14.8)	400	(12.5)	300	(9.4)
Bran	200		200		200		200		200	
Cottonseed, linseed, or soybean oil meal	....		200		400		550		700	
Total concentrates	2000		2000		2000		2000		2000	
B — For Cows Producing Annually 7000 to 7500 lbs. of 4 to 5 per cent Milk or 8500 to 9500 lbs. of 3 to 3.5 per cent Milk:										
Corn and cob meal	1563	(23.0)	1313	(19.3)	1156	(17.0)	1063	(15.6)		
Oats (2)	687	(21.5)	687	(21.5)	594	(18.6)	500	(15.6)		
Bran	250		250		250		250			
Cottonseed, linseed, or soybean oil meal	...		250		500		687		(3)	
Total concentrates	2500		2500		2500		2500			
C — For Cows Producing Annually 8500 to 9000 lbs. of 4 to 5 per cent Milk or 10,500 to 11,500 lbs. of 3 to 3.5 per cent Milk:										
Corn and cob meal	1875	(27.6)	1575	(23.1)	1387	(20.4)				
Oats (2)	825	(25.8)	825	(25.8)	713	(22.3)				
Bran	300		300		300					
Cottonseed, linseed, or soybean oil meal	...		300		600		(3)		(3)	
Total concentrates	3000		3000		3000					

(1) Protein contents of rations based on recommendations contained in Bul. 72 of Agr. Ext. Service, O. S. U., Feeding Dairy Cattle. For further information on suggested ration see this bulletin. (2) On farms where oats are limited in quantity or entirely lacking, they may be replaced by wheat bran and corn and cob meal in the ratio of one pound of bran and one pound of corn and cob meal for each two pounds of oats. (3) This ration is not included, as it is doubtful if an entire herd of high-producing cows will be able to maintain their high level of production on this type of roughage without heavier than average feeding of concentrates.

Part III -- The Hog Enterprise

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Contents

List of Tables

The Hog Enterprise

NUMEROUS METHODS of conducting the hog enterprise exist in the corn belt. Most farmers maintain a breeding herd and produce their own feeder pigs. Some farmers purchase additional pigs from their neighbors or on the market, and a few specialized feeders purchase all of their pigs. In parts of the corn belt the breeding herd is managed under a one-litter system with a rapid turnover of sows in the breeding herd. In Ohio, however, the most common method is to keep the sow in the herd for a longer period and to operate under a two-litter system.

Some farmers in the management of their hog enterprise succeed in obtaining as rapid and as much gain on a given amount of feed as is secured in experimental tests. The majority of farmers over a period of time, due to diseases, parasites, and other factors difficult to control, generally find that their rate of gain is somewhat less, and feed consumed for a given amount of gain a little above that required in experimental tests.

In calculating the amount of feed that will be needed for the hog enterprise, it is necessary that each farmer take into account such items as the number of sows, boars, and gilts in his breeding herd, the number of pigs that he normally raises to market weight per year per sow, the weight of the animals in the breeding herd, the weight at which he usually markets his hogs, the ration and method of feeding, and his general management and sanitation program.

Feed Consumed annually by the Breeding Herd on Farms on which detailed Cost Records were kept

Most farmers in the corn producing areas of Ohio include a hog enterprise in their farm organization. On many of the farms, the hog enterprise is relatively small and frequently the breeding herd will consist of a few sows only, no boar being maintained. Instead, the service of one kept by a neighbor is hired. When a sow is disposed of, the farmer either selects a gilt from among his feeders, purchases a gilt, or buys a bred sow. Thus, a considerable part of the time his breeding herd consists only of sows.

On the larger farms, a more complete breeding unit, usually sows, a boar, and one or more gilts are maintained. One or more sows will need to be replaced each year, thus the presence of

Table 38. — Feed consumed annually per animal in the hog breeding herd on corn belt farms on which detailed cost records were kept[1]

Feed	Per animal in breeding herd (pounds)
Shelled corn	1466 (26.2 bus.)
Oats	203 (6.3 bus.)
Other grains	57
Protein supplements	114
Mixed feeds, lbs. 34	
Soybeans, lbs. 14	
Tankage, lbs. 38	
Other protein, lbs. 4	
Skimmilk, dry basis, lbs. 24	
	1840

[1] Agr. Exp. Sta. Bul.—Ohio 485; Ill. 390; Iowa 294; and U.S.D.A. 1381. Feed includes that fed to sows, gilts, boars for a year, and pigs to weaning time.

one or more gilts in the larger breeding herds. Farm records distributed over a 4-year period on 434 farms in western Ohio showed that on these farms there were five sows and two other breeding animals, usually a gilt and a boar, in the breeding herd.

The total feed consumed by the sows, gilts, and boars in the breeding herd and the pigs to weaning time on farms on which detailed cost records were kept amounted to 1840 pounds of grain and other feed in addition to pasture, per animal in the breeding herd. This was made up of 26.2 bushels of shelled corn, 6.3 bushels of oats, 57 pounds of other grains, and 114 pounds of miscellaneous supplementary feeds. (See Table 38, page 46.)

Sows that are bred to farrow two litters per year consume more feed per head than is generally fed to boars and gilts, a fact which must be taken into account by farmers who have only sows in the breeding herd. The feed consumed per sow bred to farrow two litters per year, will normally be 2100 to 2200 pounds or 15 to 20 per cent greater than that consumed per animal in a breeding herd which includes boars and gilts as well as sows.

The average weight of the animals in the typical farm hog breeding herd over a period of a year has been estimated to be approximately 300 pounds per animal. Many feeding trials indicate that approximately 2 pounds of reasonably well balanced feed per 100 pounds of live weight of sow will be required per day throughout the year in addition to pasture (during at least half of the year) to maintain a sow bred to farrow two litters per year and raise the pigs to weaning weight. On this basis a sow averaging 300 pounds in weight throughout the year will require, in addition to pasture, 2190 pounds of grain and supplements. Where heavier than average sows are kept, allowance will need to be made, as more feed will be required per animal.

Feed Consumed per 100 pounds of Gain in Fattening Pigs after weaning on farms on which Detailed Cost Records were kept

On these farms, 403 pounds of shelled corn, 30 pounds of other grains, and 23 pounds of miscellaneous supplements were consumed, or a total of 456 pounds of concentrates per 100 pounds of pork produced. This is the average of both dry lot feeding and pasture feeding on these farms, as no separation was made between the feed consumed by the spring litters, which in most cases had access to pasture, and the fall litters

Table 39. — Feed consumed per 100 pounds of gain in fattening pigs after weaning on farms of which detailed records were kept[1]

		Pounds feed per cwt. of gain
Shelled corn		403 (7.2 bus.)
Other grains		30
Protein supplements		23
Mixed feed, lbs.	4	
Soybeans, lbs.	3	
Tankage, lbs.	10	
Other protein, lbs.	2	
Skimmilk, dry basis, lbs.	4	
		456

[1] Agr. Exp. Sta. Bul.—Ill. 390; Iowa 294; and U.S.D.A. 1381. It is an average of all pigs fattened during the entire year or, in other words, the average of both pasture and dry lot feeding.

which were primarily fed in dry lot. The 456 pounds of feed consumed per 100 pounds of gain is somewhat above that required when the pigs are on pasture and somewhat below that required when fed in dry lot. As it is the average of both winter and summer feed consumed by the hog feeding enterprise on these farms, it is useful in calculating the amount of feed required, only when desiring to know how much will be needed per year to fatten both the spring and fall litters. (See Table 39, page 47.)

To produce a 160-pound gain on a 45- to 65-pound pig (a market weight of 205 to 225 pounds) required on these farms 11.5 bushels of corn, 48 pounds of other grain, and 37 pounds of miscellaneous supplements in addition to some pasture per pig marketed during the year.

Feed requirements when pigs are fattened in dry lot or on pasture, with or without supplement, self fed or hand fed, and the like, are given in more detail in the following pages and tables.

Feed Consumed annually by the entire Hog enterprise as indicated by the data obtained from Detailed Cost Records

A farmer, in estimating the amount of feed that will be consumed by his entire hog enterprise, must take into account both the feed utilized by the breeding herd and that needed to fatten the pigs to market weight after weaning. In the case of his breeding herd, the amount of feed consumed annually will be only slightly affected by the number of pigs that he raises to market weight, but the total feed that will be consumed by his fattening herd will vary with the number of pigs that he raises to market weight per sow and with the weight at which he markets them. The feed consumed will also be influenced to some extent by the type of breeding herd maintained. When only sows are kept and no gilts are raised or boar maintained, the feed required will be slightly less per pig raised to market weight than where gilts and a boar are included in the herd.

Case A. When the breeding herd includes sows, gilts, and a boar. The breeding herd on a group of western Ohio farms, previously referred to, contained an average of seven animals per herd per farm, generally five sows, a gilt, and a boar. On these farms the five sows were bred to farrow both in the spring and fall, but the experience of these farmers was that out of 10 possible litters per year only 9 litters were farrowed, or 4.5 sows out of 5 farrowed two litters per year. On these farms, an average of 59 pigs were raised to market weight or 11.8 pigs per year per sow bred.

To provide the necessary feed for a year for the seven animals in the breeding herd and to produce a gain of 160 pounds per pig above weaning weight on the 59 pigs marketed annually,[1] would require, according to farm cost of production data, approximately 863 bushels of shelled corn, 45 bushels of oats, 3250 pounds of other grains, and 3000 pounds of protein supplement in addition to pasture. Or in other words, the feed required annually for the entire enterprise per animal in the breeding herd is approximately 123 bushels of corn, 7 bushels of oats, 465 pounds of other grain, and 429 pounds of protein

[1] Market weight considered to be the weight attained after 160 lbs. gain per head above weaning.

supplement in addition to pasture, or in terms of pigs raised to market weight, it is approximately 14.6 bushels of shelled corn, 0.8 bushel of oats, 55 pounds of other grain, and 51 pounds of protein supplement.

A larger number of pigs raised to market weight per sow bred than average (11.8 pigs) or marketing the pigs at higher than average weights (160 pounds above weaning) will require more feed than that indicated above, while smaller litters or lighter marketing weights will require less. The quantity of feed that will be required when some variation occurs from the average may be computed by using data given in the preceding two sections.

Case B. When the breeding herd contains only sows.—The breeding herd on many farms where the hog enterprise is relatively small will consist of two to four sows, no boar or gilts being maintained. In such cases the feed required per animal in the breeding herd is higher than where the herd includes in addition to sows, gilts and a boar. This is due to the fact that sows require more feed than gilts and boars. Taking this into account, the quantity of feed that will be needed for a year for the entire hog enterprise when the breeding herd consists of three sows and 35.4 pigs are raised to market weight (or 11.8 per sow) will be approximately 500 bushels of shelled corn, 22 bushels of oats, 1900 pounds of other grain, and 1700 pounds of protein supplement in addition to summer pasture.

When expressed in terms of animals in the breeding herd (all sows) it amounts to approximately 166.5 bushels of corn, 7.5 bushels of oats, 633 pounds of other grain, and 567 pounds of protein supplement in addition to pasture, or in terms of pigs raised to market weight, it is approximately 14.1 bushels of corn, 0.7 bushel of oats, 54 pounds of other grain, and 48 pounds of protein supplement.

If more than the average number of pigs are raised to market weight, or they are carried to heavier weights than those used above, or both, more feed will be required annually per animal in the breeding herd. Likewise, if fewer pigs are raised per sow, or marketed at lighter weights, or both, less feed will be required annually.

Feed Consumed in Producing a Gain of 160 pounds on 45- to 65-pound Pigs when Receiving —

A. A full feed of corn alone in dry lot. To produce 160 pounds of gain per pig on this ration on pigs weighing 45 to 65 pounds at the start would require a feeding period of 276 days (average daily gain 0.58 pound) and 17.3 bushels of shelled corn according to the average of 14 feeding trials. As indicated by trials where pigs weighing approximately 125 pounds each at the start and having access to alfalfa hay in addition to corn, somewhat less corn is required per 100 pounds of gain than when corn only is fed. The addition of alfalfa hay to the ration increased the rate of gain from 0.97 to 1.10 pounds per head per day in the trials where heavier pigs were used. (See Table 40, page 50.)

B. A full feed of corn and supplement in dry lot. An average of 10.7 bushels of shelled corn and 59 pounds of tankage will be consumed in producing

Table 40. — Feed consumed in fattening pigs in dry lot with grain alone, and grain and alfalfa hay

	Corn alone (light pigs)[1]	Corn alone (heavy pigs)[2]	Corn and alfalfa hay (heavy pigs)[3]	Ground barley alone[4]	Wheat and alfalfa hay[5]	Oats and alfalfa[6]	Rye and alfalfa hay[7]
Number of trials	14	22	7	2	4	1	3
Initial weight, lbs.	67	136	123	88	56	60	57
Final weight, lbs.	132	211	215	164	185	199	176
Gain per head, lbs.	65	75	92	76	129	139	119
Days on feed	112	78	84	90	113	216	123
Av. daily gain, lbs.	.58	.97	1.10	.84	1.14	.64	.96
Feed per cwt. of gain							
Grain, lbs.	604	628	540	563	414	590	469
Alfalfa hay, lbs.	. . .	. . . .	65	. . . .	59	80	77
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:							
Shelled corn, bu.	17.3	*	*	. .	. . . .	. . . .	. . . .
Barley, bu.	. . .	. . . .	. . . .	18.8	. . . .	. . . .	. . . .
Wheat, bu.	. . . .	. . . .	. . . .	. . . .	11.0	. . . .	. . . .
Oats, bu.	. . .	. . . .	. . . .	. . . .	. . . .	29.5	. . . .
Rye, bu.	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	13.4
Alfalfa hay, lbs.	. . . .	. . . .	. . . .	. . . .	94	. . . .	123
Feeding period, days	276	. . . .	. . . .	190	140	250	165

[1] Agr. Exp. Sta. Bul.—Ohio 316; Ill. 395; and data taken by permission of the Morrison Publishing Company from the 20th edition of "Feeds and Feeding."

[2] Taken by special permission of the Morrison Publishing Company, Ithaca, N. Y., from Feeds and Feeding, 20th edition, by F. B. Morrison.

[3] Agr. Exp. Sta. Bul.—Nebr. 175, 147; Kan. 192; Kan. Cir. 78.

[4] Agr. Exp. Sta. Bul.—California 342.

[5] Agr. Exp. Sta. Bul.—Mont. 284; Utah 254.

[6] Agr. Exp. Sta. Bul.—Mont. 169.

[7] Agr. Exp. Sta. Bul.—Mont. 284.

* Not computed, as heavier pigs were used in the original experiments.

Table 41.—Feed consumed in fattening pigs in dry lot on tankage and different types of grain

	Corn[1]	Barley[2] (ground)	Wheat[3]	Rye[4]	Oats[5]	Barley and Rye[6]	Oats and other grain[7]	Corn and Middlings[8]
No. of trials	58	9	8	11	4	9	20	6
Initial weight, lbs.	66	66	68	64	55	53	59	71
Final weight, lbs.	199	207	207	182	190	200	200	198
Gain per head, lbs.	133	141	139	118	135	147	141	127
Days on feed	113	100	107	113	131	117	123	98
Av. daily gain, lbs.	1.18	1.41	1.30	1.04	1.03	1.26	1.15	1.30
Feed per cwt. of gain:								
Grain, lbs.	373	400	365	442	438	215 b. 215 r.	276 o.g. 152 o.	306
Tankage, lbs.	37	27	26	21	37	9	45	27
Alfalfa hay, etc., lbs.	...	7.0	8	55	15	32		79 m.
With an initial weight of 45 to 65 lbs. the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:								
Shelled corn, bus.	10.7	...	...	...	...	...	...	8.7
Barley, bus.	...	13.3	...	...	...	7.2	...	...
Wheat, bus.	...	...	9.7	...	...	...	...	...
Rye, bus.	...	...	...	12.6	...	6.1	...	...
Oats, bus.	...	...	...	...	21.9	...	7.6	...
Other grains, lbs.	...	...	...	...	...	...	442	...
Middlings, lbs.	...	...	...	...	...	...	...	126
Tankage, lbs.	59	43	42	34	59	14	72	43
Alfalfa hay, lbs.	...	11	13	88	24	51		...
Feeding period, days	136	113	123	154	155	127	139	123

[1] Agr. Exp. Sta. Bul.—Ohio 452, 488, 552; Nebr. 243; Pa. 168; Kan. Cir. 89; Mont. 169; S. Dak. 262.
[2] Agr. Exp. Sta. Bul.—Mont. 284, 169; Utah 254; S. Dak. 262, 192.
[3] Agr. Exp. Sta. Bul.—Ohio 268; Mont. 284, 169; Utah 254; Kan. Cir. 89; Mich. Qt. 13-3.
[4] Agr. Exp. Sta. Bul.—Ohio 268; S. Dak. 271; Mont. 284; Kan. Cir. 89.
[5] Agr. Exp. Sta. Bul.—Ohio 268; Mont. 169; Ohio Bi-mo. 134.
[6] Agr. Exp. Sta. Bul.—Mont. 284.
[7] Agr. Exp. Sta. Bul.—Ohio 488; Ohio Bi-mo. 134; Ill. 414; Mont. 169.
[8] Agr. Exp. Sta. Bul.—Ohio 488; Minn. 248; Kan. Cir. 78.

Table 42.— Feed consumed in fattening pigs on pasture with grain only

	Good quality pasture with		
	Corn[1]	Barley (ground)[2]	Wheat[3]
Number of trials	31	6	4
Initial weight, lbs.	62	58	48
Final weight, lbs.	181	196	181
Gain per head, lbs.	119	138	133
Days on feed	110	108	117
Average daily gain, lbs.	1.08	1.27	1.14
Feed per cwt. of gain:			
Grain, lbs.	406	428	406
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:			
Shelled corn, bus.	11.6	...	...
Barley, bus.	...	14.3	...
Wheat, bus.	...	...	10.8
Feeding period, days	148	125	140

[1] Agr. Exp. Sta. Bul.—Ohio 552; Ill. 395; Nebr. 243; Mo. 247; S. Dak. 262.
[2] Agr. Exp. Sta. Bul.—Utah 254; Mich. Qt. 15-4; S. Dak. 262.
[3] Agr. Exp. Sta. Bul.—Utah 254; Mich. Qt. 15.4.

Table 43. — Feed consumed in fattening pigs on pasture with tankage and different types of grain

	Corn[1]	Barley[2] (ground)	Wheat[3]	Corn and Middlings[4]
Number of trials	57	14	3	7
Initial weight, lbs.	61	54	45	51
Final weight, lbs.	200	203	197	191
Gain per head, lbs.	139	149	152	140
Days on feed	103	105	109	109
Average daily gain, lbs.	1.35	1.41	1.39	1.28
Feed per cwt. of gain:				
Grain, lbs.	335	395	356	282
Tankage, lbs.	24	22	12	27
Middlings, lbs.	...	...	...	70
With an initial weight of 45 to 65 lbs. the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:				
Shelled corn, bus.	9.6	...	...	8.1
Barley, bus.	...	13.2	...	...
Wheat, bus.	...	...	9.5	...
Middlings, lbs.	...	...	...	112
Tankage, lbs.	38	35	19	43
Feeding period, days	119	113	115	125

[1] Agr. Exp. Sta. Bul.—Ohio 343, 452, and 552; Nebr. 243; Kan. Cir. 112.
[2] Agr. Exp. Sta. Bul.—Utah 254; Kan. Cir. 89; S. Dak. 252; Nebr. 251; Mich. Spec. 199; Mich. Qt., Vol. 15.
[3] Agr. Exp. Sta. Bul.—Utah 254; Mich. Qt. 15-4.
[4] Agr. Exp. Sta. Bul.—Kan. Cir. 98; Minn. 248; Mo. 247.

a gain of 160 pounds per pig when fed in dry lot, according to 58 feeding trials conducted throughout the corn belt. The feeding period required for this ration to produce a gain of 160 pounds will be 136 days. (See Table 41, page 51.)

C. A full feed of corn alone on pasture. Based on 31 trials, the average amount of shelled corn that will be consumed in addition to pasture is 11.6 bushels in making a gain of 160 pounds per pig, and 148 days will be required to make this gain. (See Table 42, page 51.)

D. A full feed of corn, a protein supplement, and pasture. The average amount of feed that will be consumed, according to many feeding trials conducted at the agricultural experiment stations and colleges, in producing a 160-pound gain per pig will be 9.6 bushels of shelled corn and 38 pounds of tankage in addition to pasture. A feeding period of 119 days will be required. (See Table 43, above.)

Feed Consumed in Producing a gain of 160 pounds on a 45- to 65-pound Pig when less than a Full Feed is fed for all or part of the Feeding Period

When pigs are fed less than a full feed for the entire feeding period, the total quantity of feed required to produce a 160-pound gain on pasture is approximately the same as when full fed, as indicated by experiment station feeding trials; however, the rate of gain is much slower. The average feed that will be required, according to the 13 trials conducted at various stations, is 9.7 bushels of shelled corn and 43 pounds of tankage. One hundred sixty-five days will be necessary to produce this gain as compared to 119 days on the same ration when full fed on pasture. (See Table 44, page 53.)

Table 44. — Feed consumed in fattening pigs on pasture when the quantity of feed fed daily is somewhat less than a full feed, for part or all of the feeding period

	Limited feeding entire period[1]	Limited feeding until weight of 125 lbs.[2]	Limited feed until 125 lb. and full feed to finish[3]
Number of trials	13	20	16
Initial weight, lbs.	55	54	62
Final weight, lbs.	209	124	212
Gain per head, lbs.	154	70	150
Length of feeding trial, days	158	87	127
Average daily gain, lbs.	.97	.80	1.18
Feed per cwt. of gain:			
Shelled corn, lbs.	338	264	321
Tankage, lbs.	27	22	18
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:			
Shelled corn, bus.	9.7	...	9.2
Tankage, lbs.	43	...	29
Feeding period, days	165	...	136

[1] Agr. Exp. Sta. Bul.—Ohio 552; Minn. 248; Ill. 247; Mo. 247.
[2] Agr. Exp. Sta. Bul.—Ohio 552.
[3] Agr. Exp. Sta. Bul.—Ohio 552; Ind. 279.

Several trials indicate that where 45- to 65-pound pigs are fed less than a full feed on pasture until they reach a weight of 125 pounds, and then full fed on pasture until a weight of 205-225 pounds is reached, it will require 9.2 bushels of shelled corn and 29 pounds of tankage to produce 160 pounds of gain per pig, and to do this 136 days will be required. (See Table 44, above.)

Limited feeding of pigs in dry lot has been found to greatly reduce the rate of gain, and in most trials the quantity of feed required to produce 100 pounds of gain was only 5 to 15 pounds of concentrates less than where full fed the same ration. In four trials at the Ohio Agricultural Experiment Station with pigs weighing approximately 45 pounds each at the beginning of the period, corn, tankage, and alfalfa hay were fed in dry lot for a period of 150 days; the average daily gain was 0.61 pound, and 515 pounds of feed was consumed per 100 pounds of gain.

Feed Consumed in the Production of a gain of 160 pounds on 45- to 65-pound Pigs when Full Fed different types of Grain

Numerous agricultural experiment stations throughout the country have tested the common types of feed grains as feeds for fattening pigs, both in dry lot and on pasture, and alone and with a protein supplement. In dry lot with a protein supplement, 10.7 bushels of corn or 9.7 bushels of wheat will produce 160 pounds of gain per pig, according to the results of feeding trials. To produce the same gain, approximately 13 bushels of barley (ground) or rye will be required and, in the case of oats, 22 bushels are necessary. Wheat in addition to a supplement or ground barley and a supplement in some tests have been found to produce a slightly more rapid gain in weight than other feed grains. (See Table 41, page 51.)

On pasture and a supplement, 9.6 bushels of corn or 9.5 bushels of wheat will produce 160 pounds of gain per pig. When ground barley is used, 13.2 bushels will be required and, as indicated by some tests, the gains will be slightly more rapid with barley than with either corn or wheat. (See Table 43, page 52.)

In dry lot without supplement or legume hay, 17.3 bushels of corn or 18.8 bushels of barley will be consumed in the production of 160 pounds gain per pig. (See Table 40, page 50.) On pasture, 11.6 bushels of corn alone or 10.8 bushels of wheat alone or 14.3 bushels of ground barley alone will be needed to produce 160 pounds of gain. Although more feed will be consumed per pig, slightly more rapid gains will be made on barley, according to the results of experiment station trials in which these feeds were tested. (See Table 42, page 51.)

Feed Consumed in the Production of a gain of 160 pounds on a 45- to 65-pound Pig when Full Fed by hand and when Self Fed

Many feeding trials have been conducted at the agricultural experiment stations and colleges in the corn belt on hand and self feeding of pigs, both in dry lot and on pasture. The results of these trials show that pigs weighing between 45 and 65 pounds when full fed by hand in dry lot will require 10.7 bushels of shelled corn and 59 pounds of tankage and a 136-day feeding period to make a total gain per pig of 160 pounds. The same ration self-fed in dry lot will require practically the same amount of feed, 10.5 bushels of corn and 48 pounds of tankage, to make the same gain, but the rate of gain per day will be greater and will reduce the time required to 113 days.

Corn and tankage, when full fed by hand to pigs on pasture, will produce a gain of 160 pounds per pig in 119 days on 9.6 bushels of corn and 38 pounds of tankage, and when self fed the same ration will produce the same gain in 110 days on 9.6 bushels of corn and 42 pounds of tankage, according to numerous experiments.

In general, the feeding trials showed that the amount of feed required per 100 pounds of gain is practically the same whether full fed by hand or self fed, although the rate of gain is considerably more rapid when self fed than when hand fed. (For additional information see Table 45, page 55.)

Feed Consumed in the Production of a gain of 160 pounds on a 45- to 65-pound Pig when different types of Protein Supplements are fed in Addition to Grain

Numerous protein feeds have been tried as supplements to grain for fattening pigs. These feeds may be divided into three groups—those of animal origin, as tankage, fish meal, and milk; those of vegetable origin, as soybean oil meal, linseed meal, alfalfa meal, cottonseed meal, and the like; and those that are mixtures of animal and vegetable proteins.

As shown by numerous feeding trials, the quantity of corn that will be required to produce 160 pounds of gain per pig in a dry lot when tankage is used as the supplement and a mineral is added, will average 10.7 bushels in addition

Table 45. — Feed consumed in fattening pigs on self feeders when fed corn and tankage in dry lot and on pasture

	Method of feeding	
	Self fed in dry lot[1]	Self fed in pasture[2]
Number of trials	15	37
Initial weight, lbs.	64	55
Final weight, lbs.	218	211
Gain per head, lbs.	154	156
Days on feed	108	107
Average daily gain, lbs.	1.42	1.46
Feed per cwt. of gain:		
Shelled corn, lbs.	366	338
Tankage, lbs.	30	26
With an initial weight of 45 to 65 lbs. the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:		
Shelled corn, bus.	10.5	9.6
Tankage, lbs.	48	42
Feeding period, days	113	110

[1] Agr. Exp. Sta. Bul.—Ohio 343, 355; Kan. Cir. 78.
[2] Agr. Exp. Sta. Bul.—Ohio 343, 355, 552; Ill. 247; Ind. 279; Mo. 247; Nebr. 214.

Table 46. — Feed consumed in fattening pigs in dry lot on corn supplemented by different types of protein feeds

	Types of protein feeds				
	Tankage[1]	Trio mix[2]	Soybean oil meal[3]	Skimmilk[4]	Linseed meal[5]
Number of trials	58	30	10	12	7
Initial weight, lbs.	66	50	53	75	64
Final weight, lbs.	199	208	205	207	174
Gain per head, lbs.	133	158	152	132	110
Days on feed	113	132	141	97	105
Average daily gain, lbs.	1.18	1.20	1.08	1.36	1.05
Feed per cwt. of gain:					
Shelled corn, lbs.	373	335	343	346	425
Tankage, lbs.	37	30	...	...	...
Linseed meal, lbs.	...	14	...	...	34
Ground alfalfa, lbs.	...	11	5	...	...
Soybean oil meal, lbs.	...	...	47	...	...
Skimmilk, lbs.	...	...	...	535	...
Mineral, lbs.	1.2	4.5	9.4	...	...
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:					
Shelled corn, bus.	10.7	9.6	9.8	9.9	12.1
Tankage, lbs.	59	48	...	...	...
Linseed meal, lbs.	...	22	...	...	54
Ground alfalfa, lbs.	...	18	8	...	...
Soybean oil meal, lbs.	...	...	69	...	...
Skimmilk, lbs.	...	...	...	856	...
Mineral, lbs.	2.0	7.2	15.0	...	...
Feeding period, days	136	133	148	118	152

[1] Agr. Exp. Sta. Bul.—Ohio 452, 488, 552; Nebr. 243; Pa. 168; Kan. Cir. 89; Mont. 169; S. Dak. 262.
[2] Agr. Exp. Sta. Bul.—Ohio 488; Ohio Bi-monthly 134; Mich. Qt. 13-3; S. Dak. 262.
[3] Agr. Exp. Sta. Bul.—Ohio 452.
[4] Taken by special permission of the Morrison Publishing Company, Ithaca, N. Y., from Feeds and Feeding, p. 870, 20th edition, by F. B. Morrison.
[5] Agr. Exp. Sta. Bul.—Ohio 349; Nebr. 243; Kan. Cir. 78, 138.

to the tankage, and a 136-day feeding period will be necessary. When fish meal is used instead of tankage, it will require, according to the average of six trials[1], 9.6 bushels of corn in addition to the fish meal and somewhat less time on feed. Skimmilk as a supplement to corn will produce a 160-pound gain per pig on 9.9 bushels of corn in addition to the milk in 118 days.

Soybean oil meal as the protein supplement, minerals, and shelled corn fed in dry lot in 10 Ohio trials indicate that a 160-pound gain may be made per pig on 9.8 bushels of shelled corn in addition to 69 pounds of supplement, 8 pounds of ground alfalfa, and 15 pounds of minerals in 148 days on feed. Linseed meal as the only supplement to corn for fattening pigs in dry lot will require 12.1 bushels of corn and 54 pounds of linseed meal to produce a 160-pound gain per pig and a feeding period of 152 days, according to the results of feeding experiments. Peanut meal when fed along with corn in dry lot will produce a 160-pound gain per pig in 128 days on 10.3 bushels of corn and 138 pounds of meal.

Many combinations of animal and vegetable protein feeds have been tried as supplements to grain for fattening pigs. The most common of these combinations is called the "Trio Mixture," which carries between 38 and 42 per cent digestible protein. The average of 30 feeding trials where a trio mixture was used as a supplement to corn, indicates that an average of 9.6 bushels of shelled corn, 88 pounds of supplement, and 7.2 pounds of mineral will be required to produce a 160-pound gain per pig. The time that will be required to make this gain will be 133 days. (For further information on feed requirements when different supplements are used in dry lot, see Table 46, page 55.)

On pasture, pigs fed tankage as a supplement to corn will require 9.6 bushels of corn and 38 pounds of tankage to produce a 160-pound gain, and soybean oil meal as a supplement will produce the same gain with 9.3 bushels of corn and 42 pounds of meal, according to trials in which these feeds were tested. Five trials where linseed meal supplemented the corn show that 9.1 bushels of corn will be required along with 62 pounds of the linseed meal. In these trials, the corn, soybean oil meal, and minerals ration made slightly more rapid gains than were made on either the linseed meal or the tankage. (See Table 47, page 57.)

Feed Consumed in the Production of a gain of 160 pounds per 45- to 65-pound Pig when full fed Corn and Supplement on different kinds of pasture

In several trials where corn and supplement were fed to pigs on alfalfa, on red clover, and on rape pasture, the quantity of corn required to produce 160 pounds of gain, according to these trials, was practically the same for each type of pasture. They show that slightly more tankage will be required on the rape pasture than on the alfalfa or red clover. The pigs on the alfalfa made the most rapid gain, followed by those on rape pasture. It is believed that much of the difference in the rate of gain in these trials was due to the fact that the average starting weight of the pigs on alfalfa pasture was greater than those on rape or clover. Those pigs pastured on clover, being the lightest in weight, tended to

[1] Agricultural Experiment Station publications: Georgia Cir. 84; So. Car. 234; No. Dak. 192; Ohio 349.

Table 47. — Feed consumed in fattening pigs on pasture on corn supplemented by different types of protein feeds

	Types of protein feeds		
	Tankage[1]	Soybean oil meal[2]	Linseed meal[3]
Number of trials	57	1	5
Initial weight, lbs.	61	47	68
Final weight, lbs.	200	206	201
Gain per head, lbs.	139	159	133
Days on feed	103	105	94
Average daily gain, lbs.	1.35	1.51	1.41
Feed per cwt. of gain:			
Shelled corn, lbs.	335	327	319
Tankage, lbs.	24	...	...
Linseed meal, lbs.	...	...	39
Ground alfalfa, lbs.	...	...	...
Soybean oil meal, lbs.	...	26	...
Mineral, lbs.	1.1	5	...
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:			
Shelled corn, bus.	9.6	9.3	9.1
Tankage, lbs.	38	...	...
Linseed meal, lbs.	...	...	62
Ground alfalfa, lbs.	...	...	...
Soybean oil meal, lbs.	...	42	...
Mineral, lbs.	1.8	8	...
Feeding period, days	119	106	113

[1] Agr. Exp. Sta. Bul.—Ohio 343, 452, 552; Nebr. 243; Kan. Cir. 112.
[2] Agr. Exp. Sta. Bul.—Ohio 452.
[3] Agr. Exp. Sta. Bul.—Ohio 349; Pa. 168; Kan. Cir. 138.

Table 48. — Feed consumed in fattening pigs on different types of forage when fed corn and tankage

	Type of forage used for pasture					
	Alfalfa[1]	Red clover[2]	Rape[3]	Bluegrass[4]	Sweet clover[2]	Soybeans[5]
Number of trials	16	12	18	4	5	3
Initial weight, lbs.	72	56	61	43	56	56
Final weight, lbs.	209	188	188	198	183	202
Gain per head, lbs.	137	132	127	155	127	146
Days on feed	97	114	104	135	113	124
Average daily gain, lbs.	1.41	1.16	1.22	1.15	1.12	1.18
Feed per cwt. of gain:						
Shelled corn, lbs.	330	330	329	364	357	359
Tankage, lbs.	23	24	29	27	25	23
Mineral and salt, lbs.	0.4	1.4	1.2	...	3.0	0.4
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:						
Shelled corn, bus.	9.4	9.4	9.4	10.4	10.2	10.3
Tankage, lbs.	37	38	46	43	40	37
Mineral and salt, lbs.	0.6	2.2	1.9	...	4.8	0.6
Feeding period, days	113	138	131	139	143	136

[1] Agr. Exp. Sta. Bul.—Ohio 552; Nebr. 243; Kan Cir. 112.
[2] Agr. Exp. Sta. Bul.—Ohio 552; Iowa 136.
[3] Agr. Exp. Sta. Bul.—Ohio 552; Iowa 136; Pa. 168; Mo. 247; S. Dak. 262.
[4] Agr. Exp. Sta. Bul.—Ohio 552; Iowa 136; S. Dak. 192.
[5] Agr. Exp. Sta. Bul.—Ohio 552.

reduce their average rate of gain somewhat below the level of the other. Pigs full fed corn and supplement on bluegrass will require 1 bushel more corn per pig to make a gain of 160 pounds than pigs on alfalfa, red clover, or, according to these trials, rape pasture. (See Table 48, page 57.)

Feed Consumed in the Production of a gain of 160 pounds per 45- to 65-pound Pig when full Fed Corn supplemented by Soybeans in different forms

The average of ten Ohio trials where corn was supplemented by soybean oil meal and minerals in dry lot indicates that 148 days on feed will be needed to produce a 160-pound gain per pig and the feed required to do this, according to these tests, will be 9.8 bushels of shelled corn, 69 pounds of soybean oil meal, 15 pounds of minerals, and a small amount of alfalfa hay.

Six trials show that where whole soybeans and mineral are added to a full feed of corn, 11.2 bushels of shelled corn, 99 pounds of soybeans, and 17 pounds of mineral will be required to produce a gain of 160 pounds per pig, but a feeding period of 216 days will be needed. Grinding the soybeans made no material change in the rate of gain or in the total quantity of feed required, according to four experiments conducted at the Ohio station.

In three trials where the beans were cooked, the rate of gain was much better and the quantity of feed required less. To produce 160 pounds of gain per pig on a ration of shelled corn, cooked soybeans, and minerals fed in dry lot, according to these tests, will require 131 days on feed and 8.1 bushels of corn, 91 pounds of soybeans, 14 pounds of minerals, and a small amount of alfalfa hay.

When soybean oil meal and minerals are fed in addition to shelled corn on good pasture, 9.3 bushels of shelled corn, 42 pounds of soybean oil meal, and 8.5 pounds of mineral, according to the results of one Ohio trial, will produce a gain per pig of 160 pounds. Whole soybeans, mineral, shelled corn, and pasture fed to pigs weighing 45 to 65 pounds will produce in 140 days a 160-pound gain per pig on 10.1 bushels of shelled corn, 77 pounds of soybeans, and 14 pounds of minerals. (See Table 49, page 59.)

Feed Consumed in the Production of a gain of 160 pounds per 45- to 65-pound Pigs when the Corn in the ration is fed in Different Forms

A series of tests conducted at the Ohio Agricultural Experiment Station to discover the effect on quantity of feed required and rate of gain when corn was fed in different forms indicated that, in general, there was practically no difference in the quantity of feed required and only slight difference in the rate of gain.

These trials show that pigs on pasture fed ear corn and tankage will produce a 160-pound gain per pig in 128 days on 9.8 bushels of corn and 38 pounds of tankage, and those fed shelled corn will gain 160 pounds each in 136 days on 9.7 bushels of corn and 41 pounds of tankage. Ground corn fed dry

Table 49. — Feed consumed in fattening pigs with corn and soybeans fed in different forms, in dry lot and on pasture[1]

	Fed in Dry Lot				Fed on Pasture		
	Corn, whole soybeans and minerals	Corn, soybean oil meal and minerals	Corn, cooked soybeans and minerals	Corn, ground soybeans and minerals	Corn, soybean oil meal and minerals	Corn, whole soybeans and minerals	Corn, cooked soybeans and minerals
Number of trials	6	10	3	4	1	4	3
Initial weight, lbs.	49	53	53	47	47	54	56
Final weight, lbs.	175	205	206	172	206	209	209
Gain per head, lbs.	126	152	153	125	159	155	153
Days on feed	170	141	125	189	105	136	108
Average daily gain, lbs.	.74	1.08	1.22	.66	1.51	1.14	1.42
Feed per cwt. of gain:							
Shelled corn, lbs.	393	343	285	380	327	355	320
Soybeans, lbs.	62	...	57	73	. .	48	41
Soybean oil meal, lbs.	...	47	...	. .	26	. .	...
Minerals, lbs.	10.8	9.4	8.7	12.5	...	...	...
Alfalfa hay, lbs.	...	5	4.0	7.0	5.3	8.5	5.6
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:							
Shelled corn, bus.	11.2	9.8	8.1	10.9	9.3	10.1	9.1
Soybeans, lbs.	99	...	91	117	.	77	66
Soybean oil meal, lbs.	...	69	...	...	42	. .	...
Minerals, lbs.	17.3	15.0	14	20	8.5	14	9.0
Alfalfa hay, lbs.	...	8	6	11	...	...	...
Feeding period, days	216	148	131	242	106	140	113

[1] Ohio Agricultural Experiment Station Bulletin 452.

will produce a 160-pound gain in 118 days on 9.4 bushels of corn and 35 pounds of tankage, and moist ground corn will produce a 160-pound gain in 124 days on 9.2 bushels of corn and 37 pounds of tankage. (See Table 50, below.)

Table 50. — Feed consumed in fattening pigs on pasture with tankage and corn fed in various forms[1]

	Ear corn	Shelled corn	Ground corn, dry	Ground corn, moist
Number of pigs	6	6	6	6
Initial weight per pig, lbs.	49.1	49.3	48.7	48.7
Final weight per pig, lbs.	199.5	205.7	201.2	202.2
Average daily gain, lbs.	1.25	1.18	1.36	1.29
Feed per cwt. of gain:				
Corn, lbs.	344.69	341.05	327.56	323.17
Tankage, lbs.	23.92	25.52	22.04	23.24
With an initial weight of 45 to 65 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 160 lbs. per head, is:				
Corn, bus.	9.8	9.7	9.4	9.2
Tankage, lbs.	38.0	41.0	35.0	37.0
Feeding period, days	128	136	118	124

[1] Ohio Agricultural Experiment Station Bulletin 552.

Feed Consumed in the Production of a gain of 80 pounds on Shoats weighing 125 to 145 pounds when Hogging off Standing Corn

Normally, spring pigs weigh 125 pounds or more by the time corn is sufficiently mature to start feeding in the fall. As shown by the results of 19 trials where pigs weighing between 125 and 145 pounds are fed tankage in addition to standing corn but no pasture, the equivalent of 6.6 bushels of shelled corn and 18 pounds of tankage will be required to produce 80 pounds of gain per pig, a gain sufficient to bring the pig to a market weight of 205 to 225 pounds. The average daily gain on this ration will be 1.75 pounds per pig, and 45 days will be required to produce a total gain of 80 pounds.

According to several trials where the pigs had, in addition to the standing corn and tankage, access to pasture, only 42 days will be required to make a total gain per pig of 80 pounds. The equivalent of 6.2 bushels of shelled corn and 12 pounds of tankage will produce an 80-pound gain per pig on this ration. The results of trials where the pigs had access to pasture in addition to the standing corn, but received no supplement, indicate that 54 days on feed and the equivalent of 8.0 bushels of shelled corn will be required to produce an 80-pound gain per pig.

When neither pasture nor a supplement is provided and only the standing corn is fed, the rate of gain will be much slower and the equivalent of 11.1 bushels of shelled corn will be required to produce 80 pounds of gain, according to these trials. Corn and soybeans grown together when fed along with tankage, the tests show, will produce an 80-pound gain in 46 days on 41 pounds of

Table 51. — Feed consumed in fattening heavy shoats by hogging off standing corn fed with and without tankage and with and without forage

	Tankage but no forage[1]	Tankage and forage[2]	Forage and no tankage[3]	No forage and no tankage[4]	Corn and soybeans grown together and tankage[4]	Corn and soybeans grown together and no tankage[4]
Number of trials	19	6	3	5	5	5
Initial weight, lbs.	127	138	143	113	116	114
Final weight, lbs.	185	205	183	134	153	137
Gain per head, lbs.	58	67	40	21	37	23
Days on feed	33	35	27	22	21	21
Average daily gain, lbs.	1.76	1.91	1.48	.95	1.76	1.10
Feed per cwt. of gain:						
Shelled corn (equivalent), lbs.	464	436	557	774	356	599
Tankage, lbs.	22	15	...	...	35	...
Soybeans, lbs.	...	...	. .	...	51	82
With an initial weight of 125 to 145 lbs., the average quantities of feed required per head to bring to a market weight of 205-225 lbs., a gain of 80 lbs. per head, is:						
Shelled corn (equivalent), bus.	6.6	6.2	8.0	11.1	5.1	8.0
Tankage, lbs.	18	12	...	...	28	...
Soybeans, lbs.	...	...	...	...	41	66
Feeding period, days	45	42	54	84	45	73

[1] Agr. Exp. Sta. Bul.—Ohio 398; Mo. 224; Mich. Sp. 200; Mich. Qt. 7-1; Kan. Cir. 118.

[2] Agr. Exp. Sta. Bul.—Ohio 398.

[3] Agr. Exp. Sta. Bul.—Mich. Special 200.

[4] Agr. Exp. Sta. Bul.—Mo. 224.

soybeans, 28 pounds of tankage, and the equivalent of 5.1 bushels of shelled corn. (See Table 51, page 61.)

Feed Consumed in the Production of 100 Pounds of Gain on Pigs of Different Weights

The quantity of feed required per pound of gain increases as the age and weight of the animal increases. Three feeding tests conducted at the Ohio Agricultural Experiment Station to determine the effect of age and weight on economy of gain showed that slightly over 300 pounds of feed, when fed in a balanced ration, was necessary to raise the pig from birth to a weight of 100 pounds. To increase the weight from 100 to 200 pounds required 359 pounds of feed. As the weight increased, the quantity of feed required increased. To raise the weight from 400 to 500 pounds required in these tests 510 pounds of feed.

The rate of gain per day was most rapid between the weights of 200 and 300 pounds, and declined when weights above 300 pounds were reached. (See Table 52, below.)

Table 52. — Feed consumed and rate of gain by pigs of different weights[1]

Weight of pigs	Daily gain (lbs.)	Pounds feed per 100 lbs. gain
Birth to 100 lbs.	0.81	304
100 to 200 lbs.	1.70	359
200 to 300 lbs.	1.83	415
300 to 400 lbs.	1.71	470
400 to 500 lbs.	1.58	510

[1] Ohio Agricultural Experiment Station Bulletin 335.

SUMMARY ON NEXT PAGE

SINCE the data contained in this publication were assembled, Mr. W. L. Robison of the Ohio Agricultural Experiment Station has published "Substitutes for Corn for Growing and Fattening Pigs" (Bul. 607, Ohio Agr. Exp. Sta.), in which he summarizes the results of many feeding trials that were conducted at various agricultural experiment stations in the United States to secure information on various feeds as complete or partial substitutes for corn in swine feeding. He compares the replacement value of the various feeds tested with shelled corn as 100 per cent.

Table 53. — Summary of the quantity of feed that will be consumed per pig from weaning to market weight, according to the results of feeding trials conducted at agricultural experiment stations and colleges

	Time required to produce 160 lbs. gain	Feed required per head to put on 160 lbs. gain on 45 to 65 lb. pigs	
	(Days)	(Bus. grain)	(Lbs. supplement)
Full fed by hand on legume pasture:			
Corn and tankage	119	9.6	38
Corn, soybean oil meal, and mineral	106	9.3	50
Corn alone	148	11.6	..
Barley and tankage	113	13.2	35
Barley alone	125	14.3	..
Wheat and tankage	115	9.5	19
Wheat alone	140	10.8	..
Self fed on legume pasture:			
Corn and tankage	110	9.7	42
Full fed by hand in dry lot:			
Corn and tankage	136	10.7	59
Corn and trio mixture	133	9.6	88
Corn and soybean oil meal	148	9.8	77
Corn and skimmilk	118	9.9	856
Corn, middlings, and tankage	123	8.7	169
Corn and alfalfa hay	145	15.4	104
Corn alone	276	17.3	..
Barley and tankage	113	13.3	54
Barley alone	190	18.8	..
Wheat and tankage	123	9.7	55
Wheat and alfalfa hay	140	11.0	94
Rye, tankage, and alfalfa hay	154	12.6	122
Rye and alfalfa hay	165	13.4	123
Oats, tankage, and alfalfa hay	155	21.9	83
Self fed in dry lot:			
Corn and tankage	113	10.5	48
Limited feeding on legume pasture:			
Limited feed full period	165	9.7	43
Limited feed to 125 lbs. and full fed to finish	136	9.2	29
Hogging down corn with heavy (125 lbs. up) shoats (80 lbs. gain per head)			
Corn, tankage, and pasture	42	6.2	12
Corn, tankage, no pasture	45	6.6	18
Corn alone	84	11.0	..

☞ All data on the quantity of grain and hay consumed or required annually or for a given amount of production in this bulletin are on a dry weight basis, unless otherwise stated. Thus an adjustment for normal shrinkage due to loss of moisture after storing must be made for corn and hay before calculating the amount of livestock that these feeds will support. (See text, page 6, for information on the determination of the quantity of farm-produced feeds available for feeding.)

Part IV -- The Horse Enterprise

◆

Contents

◆

List of Tables

The Horse Enterprise

◆

The quantity of feed consumed annually per horse on farms tends to vary with the weight of the horse and the amount of work done annually.

On farms where the number of days of work performed per horse is high, a greater quantity of grain and other feeds are required than on farms where there are fewer days of work for the horses. Idle horses frequently receive in summer only pasture and in winter dry roughage, while a considerable amount of grain is added when the horse is working every day.

The type of feed fed varies from farm to farm and depends primarily upon the feed available. In areas where oats are included in the crop rotation, they usually make up part of the horse feed, and in other areas where no oats are produced, corn alone may make up the grain ration. The roughage also varies with the type available on the farm.

In determining the annual amount of feed required per horse, the individual farm operator will need to take into account the size of his horses, the amount of work that will be done per horse, and the type of feed available. Where brood mares are kept, additional feed must be included in the estimate, as more feed is required.

Feed Consumed Annually per Draft Horse on Farms without Tractors

Before tractors were used to any extent, data were obtained on many farms in seven Ohio counties on the quantity of feed consumed annually per horse. These data will serve as a guide to the amount of feed that will be required on farms where there are no tractors and where the work is entirely done by horses. A horse consumed annually, on these farms, approximately 3,000 pounds of grain and 6,000 pounds of dry roughage, in addition to 150 days on pasture. The grain fed on these farms consisted of corn and oats. In some counties, both were fed, while in others, where little oats are grown, the grain fed was corn. Oats made up as much as 50 per cent of the grain ration in the northern part of the state, where it is more commonly raised. The dry roughage consisted of both hay and corn stover. In northeastern Ohio, very little corn was fed to horses, while in southwestern Ohio a considerable part of the winter feed was made up of corn stover. (Table 54.)

Table 54. — Feed consumed annually per draft horse

	Feed per draft horse on	
	Non-tractor farms	Tractor farms
Corn, ear, lbs.	2217 (32.6 bu.)	1537 (22.6 bu.)
Oats, lbs.	746 (23.3 bu.)	892 (27.9 bu.)
Total grain lbs.	2963	2429
Hay, lbs.	4330	3712
Stover, lbs.	1696	1746
Total dry roughage, lbs.	6026	5458
Pasture, days	154	143

Feed Consumed Annually per Draft Horse on Farms Where Both Horse and Tractor Power is Used

Since tractors have become an important source of power on many farms, cost data have been obtained on farms in three counties in the state. On these

farms, a horse consumed annually a little over 2,400 pounds of grain and 5,500 pounds of dry roughage. As on those farms where no tractors were used, the grain was made up of both corn and oats in the northern part of the state, and in the southern part of the state little or no oats were fed. The dry roughage fed included less hay and proportionately more stover on the farms with tractors than on those without tractors. (See Table 54, page 65.)

At the time these data were collected, tractors, though used on many farms for the heavier tasks as plowing and fitting ground, were not used for as many tasks as they now are. Thus it is probable that the amount of grain consumed by horses on farms where general purpose tractors are used has been somewhat further reduced. In a recent cost study on New York farms where tractors were widely used, the horses consumed a little less than 2,000 pounds of grain and 6,000 pounds of dry roughage.[1]

Feed Consumed Annually by Mares When Raising Foals

More feed is required annually to maintain mares that raise a foal each year than for those that do not. An analysis was made in Missouri of the feed consumed by two groups of Percheron mares, both groups working a similar number of hours during the year; one group raised foals, the other did not.[2] The group that raised foals consumed an average of 794 pounds or 15.5 per cent more grain, and 119 pounds or 2.0 per cent more hay per mare than the group raising no foals.

Feed Consumed by a Draft Colt from Birth to Maturity (approximately 3 Years of Age)

At the Missouri and Michigan Agricultural Experiment Stations, records were kept of the quantities of feed fed to draft colts from birth until old enough to work. At each station, two groups of colts were studied. One was fed liberally and the other conservatively. The chief difference in the rations was that those that were liberally fed received more grain and about the same amount of hay as those conservatively fed. The group of colts that were conservatively fed received from birth to maturity 4,231 pounds of grain, 6,092 pounds of hay, 1,700 pounds of other roughages, and 465 days of pasture. The quantity fed under this method is believed to be representative of quantities fed to colts on the average farm. The more liberally fed colts consumed 7,498 pounds of grain, 6,313 pounds of hay, 120 pounds of other roughages, and 456 days on pasture. (See Table 55.)

Table 55. — Feed consumed by a draft colt from birth until maturity (appproximately 3 years of age)[3]

Item	Liberal feeding	Conservative feeding
Number of trials	2	2
Grain, lbs.	7498	4231
Hay, lbs.	6313	6092
Straw, lbs.	120	1700
Pasture, days	456	465
Final weight, lbs.	1545	1487

[1] Cornell Extension Bulletin No. 395.
[2] Missouri Agricultural Experiment Station Bulletin No. 197.
[3] Michigan Special Bulletin 253; Missouri Bulletin 316.

Part V — The Sheep Enterprise

Contents

◆

◆

List of Tables

☞ All data on the quantity of grain and hay consumed or required annually or for a given amount of production in this bulletin are on a dry weight basis, unless otherwise stated. Thus an adjustment for normal shrinkage due to loss of moisture after storing must be made for corn and hay before calculating the amount of livestock that these feeds will support. (See text, page 6, for information on the determination of the quantity of farm-produced feeds available for feeding.)

The Sheep Enterprise

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THE PREDOMINANT TYPE of sheep enterprise to be found in Ohio is the breeding flock kept for both wool and lamb production. The other type of sheep enterprise is the production of fat lambs. Some men combine both, and frequently the lambs produced by the farm flock are fattened.

The feed requirement for both the breeding flock and feeder lambs varies, not only with the ration and method of feeding followed, but with the health of the animals themselves. Disease and parasites materially influence this enterprise, and heavy death loss or slow gains increase the quantity of feed required for a given weight of lambs or quantity of wool marketed.

The average farm flock of ewes receives most of its feed in the form of pasture and roughage, two types of feed for which the quality varies greatly, thus making difficult the establishment of standards. Actual farm experience of quantities fed over a period of years provides the best guide available at present, but it must be recognized that such a guide is an average of many farms, and includes some farms on which the feed fed the ewe flock is so limited that their lamb and wool crop is materially reduced, and that better and more liberal feeding than the average of the group may well result in a better lamb and wool crop.

Feed Consumed Annually per Sheep in Fine Wool Breeding Flocks on a Group of Eastern Ohio Farms

On a group of farms located in the sheep producing area of eastern Ohio, the average quantity of feed consumed per sheep per year was 48 pounds of grain, 235 pounds of dry roughage, and 0.75 acre of pasture. This includes the feed consumed by the lambs until weaned. The grain was approximately two-thirds corn and one-third oats to which was added a small amount of miscellaneous protein supplements. The dry roughage was predominantly hay, only a little corn fodder was fed. The hay included some legumes, some mixed and some straight timothy. In addition to the grain and dry roughage, each sheep utilized 0.75 acre of typical eastern Ohio pasture.

The sheep on the farms on which feed records were kept were largely of the fine wool type. Of the 5521 sheep in these flocks on October 1, 69 percent were ewes two years old or over, 25 percent were yearling ewes and ewe lambs, and the remainder were wethers and rams. For each 100 ewes bred on these farms, 84 lambs were dropped. (See Table 56, page 70.)

On few farms, some corn silage was fed during the winter to the breeding flock. On these farms, the feed consumed per sheep was 72 pounds of grain, 229 pounds of hay, 343 pounds of corn silage, and 0.6 acre of pasture. In these flocks, for each 100 ewes bred, 95 lambs were dropped.

Table 56. — Feed consumed annually per sheep in the breeding flock on a group of eastern Ohio farms with fine wool flocks[1]

Feed	Quantity per head
Grain:	
Shelled corn, lbs.	31
Oats, lbs.	14
Protein feeds, lbs.	3
Total, lbs.	48
Roughages:	
Legume hay, lbs.	63
Mixed hay, lbs.	75
Timothy hay, lbs.	74
Corn fodder, lbs.	23
Total, lbs.	235
Pasture, acre	0.75
Pasture, days	210–240

[1] Data taken from unpublished material obtained by F. L. Morison when studying some of the factors affecting the profits in sheep raising in southeastern Ohio. The unpublished data were obtained from a summary of feed records on flocks that contained on October 1, 5521 sheep of which 69.3 per cent were ewes two years or more old, 25.3 per cent yearling ewes and ewe lambs kept for replacement, 3 per cent were wethers, and 2.4 per cent were rams. For each 100 ewes bred in these flocks, 84 lambs were dropped. The feed fed annually per sheep includes the feed consumed by the lambs until weaned.

Feed Consumed Annually per Sheep in Flocks Predominantly of Medium Wool Breeds

According to detailed cost records kept on a group of farms located in Medina, Putnam, and Greene Counties in Ohio, approximately 100 pounds of grain, 350 pounds of dry roughage, and 50 pounds of silage was fed per sheep in addition to pasture. These flocks were largely made up of medium wool breeds.

In Medina County, considerably more feed was fed than in either of the other counties. This was in part due to the much shorter pasture season and partly to better care. In both Greene and Putnam Counties, corn stover made up a large part of the dried roughage. (See Table 57, page 71.)

Feed Consumed per Lamb from Weaning Time to Marketing on a group of eastern Ohio Farms where Lambs are kept through the Winter and usually clipped before Selling in the Spring

A common practice among farmers who have fine wool flocks is to carry the lambs through the winter after they are weaned and then clip them before they are sold in the spring. The weight and degree of finish on the lambs when they are sold in the spring will depend on both the original quality and health of the lambs and upon the amount of feed and kind of ration fed. The better the lambs at the start and the better the ration, the better the finish and the greater the weight when sold.

On several eastern Ohio farms where feed records were available and the practice of carrying the lambs until spring was followed, the lambs were pastured from weaning time until around the first of December, then placed on

feed until about the first of April, at which time they are clipped and sold. During the average feeding period, December to April, approximately 100 pounds of concentrate and 200 pounds of roughage were fed per lamb on these farms. The gain in weight or the degree of finish carried by the lambs at the time they were sold was not obtained. However, it may be assumed that it was representative of lambs handled in this manner on eastern Ohio farms. (See Table 58, below.)

At the Ohio Agricultural Experiment Station, lambs carried from weaning time until approximately April 1 and then clipped before selling were fed, during

Table 57. — Quantity of feed consumed annually per mature sheep on farms in Ohio on which detailed cost account records were obtained[1]

	Medina County	Greene County	Putnam County
Dates	1922–1924	1920–1924	1926–1928
Number of farms	5	14	9
Average number of mature sheep per flock	54	46	21.5
Feed per head:			
Corn shelled, lbs.	91.0	68.4	30.0
Oats, lbs.	71.8	16.8	33.0
Barley, lbs.	...	...	6.2
Other concentrates, lbs.	0.7	...	0.5
Total grain, lbs.	163.5	85.2	69.7
Legume hay, lbs.	...	...	96.8
Other hay, lbs.	339.7	100	46.5
Corn stover, lbs.	30.5	167	211.1
Total dry roughage, lbs.	370.2	267	354.4
Corn silage, lbs.	190.3	...	...
Days of pasture	179.0	*	242
Salt, lbs.	1.7	*	4.9

[1] Ohio Agricultural Experiment Station Bulletins 419, 424, and 495.
* Not reported.

Table 58. — Feed consumed per lamb from weaning time to marketing on a group of eastern Ohio farms where lambs are kept through the winter and are usually clipped before selling in the spring[1]

Feed	Quantity per lamb
Number of lambs included in study[2]	868
Grain:	
Shelled corn, lbs.	62
Oats, lbs.	27
Protein feeds, lbs.	5
Total, lbs.	94
Dry roughage:	
Legume hay, lbs.	53
Mixed hay, lbs.	64
Timothy hay, lbs.	63
Corn fodder, lbs.	10
Total, lbs.	190

[1] Source of data: Unpublished material, Department of Rural Economics, Ohio State University.
[2] The lambs were fed grain and hay an average of 125 days, starting about December 1 and ending about April 1 when the lambs were sold. The lambs were pastured between weaning and the time they were placed on feed in December.

Table 59. — Feed consumed annually per Merino ewe in flocks where the lambs are dropped in March and April, weaned in the late summer, fed out during the winter, and sold at approximately one year of age as clipped fat lambs, and the feed fed per lamb during the winter lamb feeding period[1]

Item	Feed per ewe per year including feed fed the lamb until sold as a clipped fat lamb	Feed per ewe per year including the lambs to weaning time	Feed fed per lamb of Southdown Merino cross-breeding during fattening period	Feed fed per lamb of straight Merino breeding during fattening period
Period of time	1 year	1 year	131 days	131 days
Number of head of ewes	79	79	....	....
Number of head of lambs	82	82	39	43
Initial weight of lambs, lbs.			66.2	62.0
Final weight of lambs, lbs.	81.3	66.4	80.4	76.5
Total gain in weight on lambs, lbs.	81.3	66.4	14.2	14.5
Weight of lamb wool per fleece, lbs.	7.9		6.3	8.9
Weight of ewe wool per fleece, lbs.	9.1	9.1	...	...
Feed:				
Shelled corn, lbs.	177.0	69.3	102.0	105.0
Supplement, lbs.	36.3	27.0	8.5	9.3
Hay (95% legume), lbs.	321.0	129.0	183.0	187.0
Corn silage, lbs.	462.0	434.0	27.0	25.0

[1] Data obtained from Ohio Agricultural Experiment Station Bulletin 367.

Table 60. — Feed consumed in fattening lambs with shelled corn, a protein supplement, and a dry roughage

	Shelled corn and protein supplement with			
	Corn stover[1]	Timothy hay[2]	Clover hay[3]	Alfalfa hay[4]
Number of trials	5	6	7	16
Weight at beginning, per lamb, lbs.	65.7	63.3	64.3	62.1
Weight at end, per lamb, lbs.	91.4	85.9	92.6	94.1
Gain per lamb, lbs.	25.7	22.6	28.3	32.0
Days on feed	82	75	83	86
Average daily gain, lbs.	.31	.30	.34	.37
Feed requirements per 100 lbs. of gain:				
Shelled corn, lbs.	417	411	325	358
Hay (or stover), lbs.	416	344	422	298
Supplement, lbs.	69	57	55	53
With an initial weight of — lbs.	55–70	55–70	55–70	55–70
Assuming that the gain required per lamb to give a fairly satisfactory finish is — lbs.	27	27	27	27
Feeding period, days	87	90	79	73
Then the total feed requirement per head is:				
Shelled corn, lbs.	113	111	88	97
Hay (or stover), lbs.	112	93	114	80
Supplement, lbs.	18.6	15.4	14.9	14.3

[1] Agr. Exp. Sta. Bul.—Ohio 245; Minn. 306.
[2] Agr. Exp. Sta. Bul.—Indiana 162; Ohio 245; Minn. 306.
[3] Agr. Exp. Sta. Bul.—Indiana 162, 168; Mich. 113; Ohio 245.
[4] Agr. Exp. Sta. Bul.—Minn. 306; Nebr. 173, 197, 211; Ohio 245.

a 131-day feeding period, approximately 100 pounds of shelled corn, 10 pounds of supplement, 185 pounds of hay, and 25 pounds of corn silage. At the beginning of the feeding, the Southdown-Merino crossbred lambs weighed 66 pounds and the straight Merino bred lambs weighed 62 pounds. The final weight of the crossbred lambs before clipping was 87 pounds and the Merino lambs 85 pounds. (See Table 59, page 72.)

Feed Consumed in the Production of Fat Lambs

The average of many feeding records kept both on farms and at experiment stations indicate that most feeder lambs enter the feed lot at weights ranging from 55 to 70 pounds and are sold at weights ranging from 80 to 100 pounds per lamb.[1] The average gain made during the feeding period considered necessary to produce a fairly satisfactory finish, according to the average of these records and trials, was 27 pounds. For the sake of uniformity in arriving at the quantity of feed consumed in the production of a fairly satisfactory finish on lambs, we have calculated the quantity of feed required to produce 27 pounds gain per lamb for each ration considered.

Feed Consumed in the Production of a Fairly Satisfactory Finish on a Lamb Weighing 55 to 70 Pounds at the Start of the Feeding Period when Fed a Ration containing—

A. *Shelled corn, supplement and dry roughage.*—Alfalfa hay, shelled corn, and a supplement based on the results of feeding trials will produce a gain of 27 pounds per lamb in 73 days on 97 pounds of shelled corn, 14 pounds of supplement, and 80 pounds of alfalfa hay. In similar tests where clover hay was used in place of alfalfa hay, the gains were slightly less rapid; however, a little less grain and more hay were consumed.

Rations of corn stover with corn and a supplement, and timothy hay with corn and a supplement when tested at various experiment stations gave slower gains than either clover or alfalfa. Both will require the feeding of more corn and supplement to produce a gain per lamb of 27 pounds. According to trials in which corn stover was the dry roughage used, an 87-day feeding period will be required and 113 pounds of shelled corn, 112 pounds of corn stover, and 18.6 pounds of supplement will be consumed in the production of a gain per lamb of 27 pounds. (See Table 60, page 72.)

B. *Corn silage with other feeds.*—Shelled corn, corn silage, a supplement, and legume hay fed to lambs weighing 55 to 70 pounds at the beginning of the feeding period will produce a fairly satisfactory finish in 77 days. Based on the results of numerous trials this will require 84 pounds of shelled corn, 91 pounds of corn silage, 12 pounds of supplement, and 71 pounds of legume hay.

According to the results of ten trials in which lambs were fed a ration of shelled corn, corn silage, and legume hay, no supplement being used, an 84-day

[1] Weight before shearing.

Table 61. — Feed consumed in fattening lambs with a ration of shelled corn, corn silage, and legume hay, and the same ration plus a protein supplement

	Ration — Shelled corn, corn silage, and legume hay[1]	Ration — Shelled corn, corn silage, legume hay, and a supplement[2]
Number of trials	10	11
Weight at beginning, per lamb, lbs.	60.5	60.0
Weight at end, per lamb, lbs.	87.3	88.3
Gain per lamb, lbs.	26.8	28.3
Days on feed	83	80
Average daily gain, lbs.	.32	.35
Feed required per 100 lbs. of gain:		
Shelled corn, lbs.	370	312
Corn silage, lbs.	346	336
Legume hay, lbs.	309	265
Supplement, lbs.	...	43
With an initial weight of — lbs.	55–70	55–70
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	27	27
Feeding period, days	84	77
Then the total feed required per head is:		
Shelled corn, lbs.	100	84
Corn silage, lbs.	93	91
Legume hay, lbs.	83	72
Supplement, lbs.	...	11.6

[1] Agr. Exp. Sta. Bul.—Ind. 162, 168; Mich. Special Bul. 233; Nebr. 173, 197, 211.

[2] Agr. Exp. Sta. Bul.—Ind. 162, 168; Mich. Special Bul. 233; Nebr. 197, 211.

Table 62. — Feed consumed in fattening lambs with a ration of ear corn and legume hay and the same ration plus a protein supplement[1]

	Ration — Ear corn and legume hay	Ration — Ear corn, legume hay, and a protein supplement
Number of trials	4	7
Weight at beginning, per lamb, lbs.	66.3	65.3
Weight at end, per lamb, lbs.	90.5	92.8
Gain per lamb, lbs.	24.2	27.5
Days on feed	68	71
Average daily gain, lbs.	.36	.39
Feed required per 100 lbs. of gain:		
Ear corn, lbs.	634	557
Legume hay, lbs.	367	326
Supplement, lbs.	...	48
With an initial weight of — lbs.	55–70	55–70
Assuming that the gain required per head to give a fairly satisfactory finish is — lbs.	27	27
Feeding period, days	75	69
Then the total feed required per head is:		
Shelled corn equivalent, lbs.[2]	137	120
Legume hay, lbs.	99	88
Supplement, lbs.	...	12.9

[1] Minnesota Agricultural Experiment Station Bulletin 306.

[2] No adjustment was made for the high moisture content of the ear corn used in these trials.

feeding period will be required and 100 pounds of shelled corn, 93 pounds of corn silage, and 83 pounds of legume hay will be consumed per lamb in the production of a gain of 27 pounds per lamb. (See Table 61, page 74.)

C. *Ear corn with other feeds.*—Rations in which the corn was fed in the ear rather than shelled were tried at the Agricultural Experiment Station at Minnesota. Most of these trials were started early in the fall and new corn, carrying a high percentage of moisture, was used. In one group of trials, the ear corn was fed in a ration containing a supplement and legume hay. Lambs receiving this ration as shown by these tests required a 69-day feeding period to produce a gain of 27 pounds per lamb and consumed the equivalent of 120 pounds of shelled corn, 88 pounds of legume hay, and 13 pounds of supplement.[1] Where only ear corn and alfalfa hay are fed the equivalent of 137 pounds of ear corn and 99 pounds of hay will be required to produce a gain of 27 pounds per lamb according to Minnesota's experience. (See Table 62, page 74.)

[1] The gain was a little less rapid where ear corn was used than where shelled corn was used in trials at Minnesota, but both sets of trials made gains somewhat more rapid than the average of the 16 trials conducted at several stations where shelled corn was used (see table 60, page 72). No adjustment was made for the high moisture content of the ear corn used in these trials.

Table 63. — Feed consumed in fattening lambs with rations in which grains other than corn are used

	Oats, legume hay, supplement[1]	Oats, corn silage, legume hay[2]	Oats, corn silage, legume hay, supplement[3]	Oats (4 parts), Corn (6 parts), legume hay, supplement[1]	Wheat, legume hay, supplement[4]
Number of trials	2	6	2	2	5
Weight at beginning, per lamb, lbs.	65.0	64.7	66.0	64.2	68.1
Weight at end, per lamb, lbs.	97.7	88.3	94.4	98.6	101.2
Gain per lamb, lbs.	32.7	23.6	28.4	34.4	33.1
Days on feed	73	88	82	73	82
Average daily gain, lbs.	.45	.27	.35	.47	.40
Feed requirement per 100 lbs. of gain:					
Oats, lbs.	441	542	540	165	...
Wheat, lbs.	...	...	...	...	378
Corn, lbs.	...	...	...	248	...
Corn silage, lbs.	...	371	244	...	...
Legume hay, lbs.	237	373	241	229	272
Supplement, lbs.	44	...	46	44	53
With an initial weight of — lbs.	55–70	55–70	55–70	55–70	55–70
Assuming that the gain required per lamb to give a fairly satisfactory finish is — lbs.	27	27	27	27	27
Feeding period, days	60	100	77	57	68
Then the total feed requirement per head is:					
Oats, lbs.	119	146	146	45	...
Wheat, lbs.	...	...	...	...	102
Corn, lbs.	...	...	...	67	...
Corn silage, lbs.	...	100	66	...	...
Legume hay, lbs.	64	101	65	62	73
Supplement, lbs.	11.9	...	12.4	11.9	14.3

[1] Agr. Exp. Sta. Bul.—Minn. 306.
[2] Agr. Exp. Sta. Bul.—Ind. 360; Mich. Special 233.
[3] Agr. Exp. Sta. Bul.—Ind. 312, 333.
[4] Agr. Exp. Sta. Bul.—Mich. 113; Minn. 306.

D. *Oats with other feeds.*—The results of only a limited number of experiments are available in which oats supplied all or part of the grain in the ration. In two trials at Minnesota in which a ration of oats, a supplement, and legume hay was fed, the rate of gain per lamb was very good. The quantity of feed that will be required to produce a gain of 27 pounds per lamb as shown by these tests will be — oats, 119 pounds; supplement, 12 pounds; and hay, 64 pounds. In six trials in which a ration of oats, corn silage, and legume hay was fed, the gains were much less rapid. It will require 100 days to produce a gain of 27 pounds per lamb and the feed that will be needed per lamb will be 146 pounds of oats, 100 pounds of corn silage, and 101 pounds of hay, according to these six trials.

Normally, oats are not fed alone but mixed with corn. Based on two Minnesota trials in which a mixture of corn and oats were fed together with a supplement and legume hay, 45 pounds of oats, 67 pounds of corn, 12 pounds of supplement, and 62 pounds of hay will be required to produce a gain of 27 pounds per lamb. (See Table 63, page 75.)

E. *Wheat with other feeds.*—The rate of gain on lambs and the quantity of feed consumed when a ration containing wheat is fed are similar to those when corn is used. One hundred two pounds of wheat, 14 pounds of supplement, and 73 pounds of hay will be needed per lamb to produce a gain of 27 pounds, and an average feeding period of 68 days will be required, as shown by 5 trials where this ration was used. (See Table 63, page 75.)

Table 64. — Feed consumed in fattening lambs with a ration of shelled corn and dry roughage

	Shelled corn with					Alfalfa hay alone[6]
	Corn stover[1]	Timothy hay[2]	Clover hay[3]	Alfalfa hay[4]	Soybean hay[5]	
Number of trials	4	6	10	20	3	4
Weight at beginning, per lamb, lbs.	64.0	63.2	64.2	62.3	60.0	56.0
Weight at end, per lamb, lbs.	88.4	79.8	91.8	89.8	90.7	66.6
Gain per lamb, lbs.	24.4	16.6	27.6	27.5	30.7	10.6
Days on feed	85	75	77	84	92	85
Average daily gain, lbs.	.29	.22	.36	.33	.33	.12
Feed required per 100 lbs. gain:						
Shelled corn, lbs.	503	551	370	367	333	...
Hay (or stover), lbs.	354	460	402	407	507	3112
With an initial weight of — lbs.	55–70	55–70	55–70	55–70	55–70	
Assuming that the gain required per head to give a fairly satisfactory finish, is — lbs.	27	27	27	27	27	(Cannot produce satisfactory finish on Alfalfa hay alone)
Feeding period, days	93	123	75	82	82	
Then the total feed required per head is:						
Shelled corn, lbs.	136	149	100	99	90	
Hay (or stover), lbs.	96	124	109	110	137	

[1] Agr. Exp. Sta. Bul.—Minn. 306; Ohio. 245.

[2] Agr. Exp. Sta. Bul.—Ind. 162; Minn, 306; Ohio 245.

[3] Agr. Exp. Sta. Bul.—Ind. 162, 168; Mich. 113; Ohio 245.

[4] Agr. Exp. Sta. Bul.—Ill. 260, 338; Mich. Special 233; Minn. 306; Nebr. 173, 197, 204, 211; Ohio 245.

[5] Agr. Exp. Sta. Bul.—Ill. 260, 338.

[6] Agr. Exp. Sta. Bul.—Nebr. 194; Nev. 106.

F. *Corn and dry roughage only.*—A common practice on many farms is to feed only shelled corn and a dry roughage to lambs. Rations containing shelled corn and dry roughage of various kinds have been tried at several experiment stations. The most common ration of this type tested is shelled corn and alfalfa hay. Based on 20 trials with this ration, a gain of 27 pounds per lamb will be produced in 82 days and the average feed needed per lamb will be 99 pounds of shelled corn and 110 pounds of alfalfa hay. Similar results were obtained in feeding trials when clover hay and soybean hay were used in the ration instead of alfalfa hay.

When lambs are fed a ration of shelled corn and timothy hay, a feeding period of 123 days will be required and the lambs will consume 149 pounds of shelled corn and 124 pounds of hay in producing a gain of 27 pounds each. In trials where corn stover was used, the results averaged better in four trials than in those where timothy hay was used. To produce a gain of 27 pounds, 93 days will be required when a ration of shelled corn and corn stover is fed and the quantity of feed consumed per lamb will be 136 pounds of corn and 96 pounds of corn stover, according to these trials. (See Table 64, page 76.)

G. *Different types of protein supplements.*—The most common supplement used in lamb feeding is linseed meal. The average amount of feed that will be required per lamb, as shown by a large number of tests in which linseed meal was used as the supplement to corn and legume hay, will be 95 pounds of corn, 90 pounds of hay, and 15 pounds of supplement, and an average feeding period of 75 to 80 days will be required to produce a gain per lamb of 27 pounds. Other similar supplements, such as soybean oil meal, cottonseed meal, gluten meal, etc., and combinations of vegetable protein feeds have been tried at the various experiment stations. It would appear, according to their results, that only slight variations will occur in the quantity of feed required and rate of gain from those obtained when linseed meal is used.

Feed Consumed in the Production of a Fairly Satisfactory Finish on a Lamb weighing between 55 and 70 Pounds at the Start of the Feeding Period according to Records kept on Farms where Lamb Feeding was an important Enterprise[1]

Farm records were kept on 164 Michigan farms over a 5-year period, during which time these farmers fed a total of 130,500 lambs. The average weight of these lambs at the beginning of the feeding period was 63 pounds, and at the close 89 pounds, a gain per lamb of 26 pounds. The average length of feeding period on these farms was 110 days. The amount of concentrates fed per lamb during that time was 141 pounds, and the total roughage fed averaged 125 pounds. (See Table 65, page 78.)

[1] Michigan Agricultural Experiment Station Special Bulletin No. 284.

Table 65.—Feed consumed per lamb according to cost records kept on a group of 164 Michigan farms[1]

Item	Average
Number of lambs per farm at start	796
Number of lambs per farm at finish	762
Death loss, per cent	4.2
Lamb weight at start, lbs.	63.3
Gain per lamb, lbs.	25.6
Daily gain per lamb, lbs.	.23
Days on feed	110
Feed per cwt. of gain:	
Concentrate, lbs.	551
Roughage, lbs.	488
Feed used per finished lamb:	
Corn, lbs.	62
Oats, lbs.	14
Screenings, lbs.	19
Salvaged grain, lbs.	16
Other grain and concentrates, lbs.	30
Total concentrates, lbs.	141
Hay, lbs.	88
Other roughage, lbs.	37
Total roughage, lbs.	125

[1] Michigan Agricultural Experiment Station Special Bulletin No. 284. Total number of lambs fed on these 164 farms during the 5 years was 130,500.

Table 66. — Summary of the quantity of feed that will be consumed in the production of a fairly satisfactory finish on lambs with different types of rations based on the results of agricultural experiment station feeding trials

Ration	Days required to produce a gain of 27 lbs. per lamb	Quantity of feed required to produce a gain of 27 lbs. per lamb[1]			
		Grain, lbs.	Supplement, lbs.	Corn silage, lbs.	Dry roughage, lbs.
Corn, corn stover	93	136	...	...	96
Corn, timothy hay	123	149	...	...	124
Corn, clover hay	75	100	.	. .	109
Corn, alfalfa hay	82	99	...	...	110
Corn, soybean hay	82	90	..	...	137
Corn, supplement, corn stover	87	113	18.6	...	112
Corn, supplement, timothy hay	90	111	15.4	...	93
Corn, supplement, clover hay	79	88	14.9	...	114
Corn, supplement, alfalfa hay	73	97	14.3	. .	80
Corn, corn silage, legume hay	84	100	...	93	83
Corn, supplement, corn silage, legume hay	77	84	11.6	91	72
Ear corn, legume hay[2]	75	137	.	...	99
Ear corn, supplement, legume hay[2]	69	120	12.9	...	88
Oats, supplement, legume hay	60	119	11.9	...	64
Oats, corn silage, legume hay	100	146	...	100	101
Oats, supplement, corn silage, and legume hay	77	146	12.4	66	65
Oats (4 parts) Corn (6 parts) supplement, legume hay	57	112	11.9	...	62
Wheat, supplement, legume hay	68	102	14.3	...	73

[1] The gain considered necessary to produce a fairly satisfactory finish per lamb with an initial weight of 55-70 pounds.

[2] Ear corn on a shelled corn basis but not adjusted for high moisture content.

Part VI — The Poultry Enterprise

◆

Contents

List of Tables

The Poultry Enterprise

◆

ALMOST EVERY FARM in the state maintains a poultry flock. On many of these farms the flocks are small and are kept primarily for the production of eggs and meat for home consumption. On such farms kitchen waste and gleaning about the farmstead make up a large part of the feed consumed. On a majority of the farms in the state poultry receives more attention, and production is carried on for sales as well as for home use. Among this group are some farms on which poultry production is a major enterprise and much attention is devoted to it. The feed fed and the production tend to vary between these two extremes — that is, production for home use and intensive commercial production.

Feed and production records kept on farm poultry enterprises and the results of experimental work carried on at various agricultural experiment stations and colleges provide a source of information useful in determining the quantity of feed needed annually for a poultry enterprise. In view of the fact that the total feed required for a poultry enterprise is affected so materially by various factors, it is necessary that the more significant of these be recognized and taken into account when estimating the amount of feed needed.

Probably one of the most significant factors having a bearing on the amount of feed consumed annually for the entire enterprise per 100 birds is the intensity with which the enterprise is conducted. The poultry flock that is maintained primarily to supply meat and eggs for the family is usually small. The birds in such flocks often have almost unlimited range of the farmstead, thus availing themselves of much waste feed and table scraps, which materially reduces their need for other feeds. Generally, such flocks are fed only small amounts of concentrates and frequently only the minimum of care is given them. In contrast to this, we have the larger commercial flocks that are fed all of the feed they can be encouraged to consume in order to stimulate the maximum production. Between these two extremes are found many farm flocks in which a more moderate amount of care and feed is provided.

A second significant factor having a bearing on the amount of feed needed annually for the entire enterprise per 100 birds is the number of pullets that need to be produced each year to maintain the flock. The greater the number of young birds that must be raised each year to maintain the laying flock at a given level, the greater the quantity of feed that will be consumed by the young flock in addition to that which is fed to the laying flock. The number needed for replacement is determined by the number of birds culled out of the laying flock and sold or consumed during the year and the number that die.

A third factor that obviously will have a bearing on the feed consumed per 100 birds is the type of chickens kept. The light breeds, such as the Leghorn, require and consume less feed per bird per year than the heavier breeds, such as the Rocks, Reds, etc.

Egg production, like milk production, is an inherited ability, and tends to vary considerably between individual birds. Birds from low producing stock, though fed well, will generally not produce as many eggs on the same amount

of feed and care as will birds of better breeding. Thus, if a poultry producer wishes to estimate the production that may be obtained from a given amount of feed, he will need to take into account the productive ability of the poultry flock and, in addition, probable losses during the year due to culling and mortality.

As mentioned previously, the annual feed requirements of a poultry enterprise include both the feed consumed by the laying flock and by the young stock raised to provide the pullets for replacement. It is, therefore, necessary that both be determined and included when preparing an estimate of feed requirements for the entire enterprise. In Sections I, II, and III of this report that follow, the feed consumed by the laying flock during a year, and the feed consumed by the young stock raised to produce the necessary replacements for flocks kept for commercial production, have been first considered separately and then combined into a total feed requirement per year for the entire enterprise.

In Section IV in which the farm poultry flocks receive the minimum of feed and care, kept primarily to supply home consumption needs, the amount of feed fed annually is the combined amount fed the laying flock and the young flock.

In Section V, the feed required for the young stock is set up separately. In Section VI, the feed consumption per bird in the laying flock during a 12-month period, exclusive of the feed needed to produce the replacements, is given for various types of rations.

In determining the feed requirements for the entire poultry enterprises for a year, October 1 is considered as the starting date. This is chosen as being the approximate time that most producers complete the culling of the old flock, place the new pullets in the laying houses, and dispose of the remaining young stock not used for replacements.

I. *Feed Consumed by High Producing Leghorn Flocks Receiving Better Than Average Care and Management*

Poultry records kept on 39 farms on which the poultry enterprise was given better than average care and management provide a good guide to feed requirements for flocks similarly managed.[1] These 39 flocks contained on October 1, 19,373 Leghorn hens and pullets. The birds were fed well balanced rations, cod liver oil was included in most of the winter rations, electric lights were used on nearly every farm during the winter, and in the summer most of the birds had access to range. Careful culling was also practiced on these farms. The egg production ranged from 12 to 15 dozen eggs per bird.

On some of the farms on which the poultry records were kept, home-grown grains were used as part of the mash and on others the mash was purchased. Inasmuch as most of the records carried no breakdown as to the contents of the mash, all the mash fed, whether entirely purchased or partly

[1] The poultry records kept on these farms were under the supervision and in cooperation with the Poultry Extension Specialists at the Ohio State University.

Table 67. — Feed consumed by high producing Leghorn flocks receiving better than average care and management[1]

A — The feed fed per year to the laying flock for each 100 birds (hens and pullets) in the flock on October 1.

Grains:			
Shelled corn	2045 lbs.	or	36.5 bu.
Wheat	1053 lbs.	or	17.6 bu.
Oats	640 lbs.	or	20.0 bu.
Mash	3150 lbs.	or	31.50 cwt.
Shell and grit	267 lbs.	or	2.67 cwt.
Total	7155 lbs.		

B — The feed fed to the young stock in the production of the 49 pullets required to restore the laying flock to 100 birds (hens and pullets) on October 1.

Grains:			
Corn (ground or cracked)	403 lbs.	or	7.2 bu.
Wheat (ground or whole)	220 lbs.	or	3.7 bu.
Oats (ground or whole)	72 lbs.	or	2.2 bu.
Mash	1061 lbs.	or	10.61 cwt.
Shell and grit	9 lbs.	or	0.09 cwt.
Total	1765 lbs.		

C — Total feed fed annually to the entire poultry enterprise per 100 birds (hens and pullets) in the laying flock on October 1.

Grains:			
Shelled corn	2448 lbs.	or	43.7 bu.
Wheat	1273 lbs.	or	21.3 bu.
Oats	712 lbs.	or	22.2 bu.
Mash[2]	4211 lbs.	or	42.1 cwt.
Shell and grit	276 lbs.	or	2.8 cwt.
Total	8920 lbs.		

[1] Data obtained from 39 Farm Poultry Record Keepers with a total of 19,373 birds on October 1. The average number of hens in these flocks for the year was 15,427, and the number at the end of the year was 9,862.

[2] See footnote 3 below for further information regarding the probable ingredients and desired protein content of the mash. See also text, Part C, page 84.

provided by home-grown grains, was computed as mash and not broken down into its ingredients.[3]

For each 100 birds (hens and pullets) in these flocks on October 1, 51 remained on September 30, one year later, the difference being accounted for by home consumption, culling, and mortality. To maintain their flocks, these poultrymen raised sufficient young stock each year to provide the 49 pullets required to restore the laying flock to 100 on October 1.

A. *The feed consumed per year by the laying flock* on these farms averaged, per 100 birds housed on October 1, 7155 pounds of concentrates. This was made up of 2045 pounds of corn, 1053 pounds of wheat, 640 pounds of oats, 3150 pounds of mash (part provided by home-grown grains, and part purchased), and 267 pounds of grit and shell. (See Table 67, part A, above.)

[3] On farms where feed grains are abundant, each 100 pounds of the mash mixture may contain, according to data contained in Ohio Agricultural Extension Service Bulletin 126, approximately 33 lbs. of ground corn, 25 lbs. of ground wheat, and 10 lbs. of ground oats, along with 5 lbs. of alfalfa leaf meal, 8 lbs. of meat scrap or fish meal, 6 lbs. of dried milk, 9 lbs. of soybean oil meal or other vegetable proteins, 3 lbs. of mineral and 1 lb. of fish oil. This will give a mash containing 18 to 20 per cent protein and, when fed along with the other grain listed above in a ratio of about one-half scratch grain and one-half mash, will provide a fairly well balanced feeding program. If the mash is purchased, a mash containing 18 to 20 percent protein will be necessary if the feed ration is to be a balanced one. For more complete information as to the possible content of the ration, see Ohio Agricultural Extension Service Bulletin 126.

B. *The feed consumed by the young stock* in the production of the 49 pullets needed to restore the laying flock to 100 birds on October 1 includes the feed fed to the cockerels until they are disposed of and to the pullets until they are taken into the laying flock on October 1. This amounts to 1765 pounds, which was made up of 403 pounds of ground or cracked corn, 220 pounds of ground wheat, 72 pounds of ground oats, 1061 pounds of mash, and 9 pounds of shell and grit. (See Table 67, part B, page 83.) Approximately 150 baby chicks of mixed sexes were brooded per 49 pullets needed for replacements.

C. *The total feed consumed by the entire poultry enterprise* on these farms per 100 birds in the laying flock on October 1 was 8920 pounds. This includes the 7155 pounds of feed fed to the laying flock and the 1765 pounds of feed fed to the young flock raised to provide the 49 pullets required for replacements. In other words, for each 100 birds (hens and pullets) housed on October 1, these farmers fed 8920 pounds of concentrates during the year (see Table 67, Part C, page 83.)

If, in addition to the scratch grain, home grown grains are used to provide part of the ingredients of the mash, the amount that home grown grains may make up of the total feed consumed by the entire poultry enterprise per 100 birds in the laying flock October 1 will be, if the ration is to be fairly well balanced, approximately 68 bushels of shelled corn, 39 bushels of wheat, and 35 bushels of oats along with 17 cwt. of purchased protein supplement, minerals, fish oil, etc. (See footnote 3, page 83.)

II. *Feed Consumed by Leghorn Flocks of Average Production Receiving Average Care and Management*

Poultry records kept on 18 farms on which the poultry enterprise received average care and management provide a satisfactory guide to annual feed requirements for flocks similarly managed.[1] These 18 flocks contained on October 1, 5948 Leghorn hens and pullets. Some culling was practiced on these farms, rations were reasonably well balanced, the birds were allowed summer range and farmstead gleanings, and kitchen waste frequently supplied some of the feed consumed by the birds. Egg production in these flocks ranged from 9 to 11 dozen eggs per hen per year. For each 100 hens and pullets in the flock on October 1, 48 remained on September 30, one year later, the difference of 52 birds being accounted for by home consumption, culling, and mortality. To maintain the flocks on these farms, sufficient young stock was raised each spring and summer to provide the 52 pullets needed to restore the flock on October 1 to 100 birds (hens and pullets).

A. *The feed consumed per year by the laying flock* on these 18 farms averaged 5816 pounds per 100 birds in the flock on October 1. This was made up of 1627 pounds of shelled corn, 810 pounds of wheat, 311 pounds of oats, 2889 pounds of mash (part provided by home grown grain and part purchased) and 179 pounds of shell and grit. (See Table 68, part A, page 85.)

[1] The poultry records kept on these farms were under the supervision and in cooperation with the Poultry Extension Specialists at the Ohio State University.

B. *The feed consumed by the young stock* in the production of the 52 mature pullets needed to restore the laying flock to 100 birds on October 1 includes the feed fed to the cockerels until they are disposed of and to the pullets until they are taken into the laying flock on October 1. This amounted to 1872 pounds of concentrates, which were composed of 428 pounds of ground or cracked corn, 232 pounds of ground wheat, 76 pounds of ground oats, 1127 pounds of mash, and 9 pounds of shell and grit (see Table 68, part B, below.) Approximately 155 baby chicks of mixed sexes were brooded per 52 pullets needed for replacement.

Table 68. — Feed consumed by Leghorn flocks of average production receiving average care and management[1]

A — The feed fed per year to the laying flock for each 100 birds (hens and pullets) in the flock on October 1.

Grains:			
Shelled corn	1627 lbs.	or	29.1 bu.
Wheat	810 lbs.	or	13.5 bu.
Oats	311 lbs.	or	9.7 bu.
Mash	2889 lbs.	or	28.9 cwt.
Shell and grit	179 lbs.	or	1.8 cwt.
Total	5816 lbs.		

B — The feed fed to the young stock in the production of the 52 mature pullets required to restore the laying flock of 100 birds (hens and pullets) on October 1.

Grains:			
Corn (ground or cracked)	428 lbs.	or	7.6 bu.
Wheat (ground or whole)	232 lbs.	or	3.9 bu.
Oats (ground or whole)	76 lbs.	or	2.4 bu.
Mash	1127 lbs.	or	11.30 cwt.
Shell and grit	9 lbs.	or	.09 cwt.
Total	1872 lbs.		

C — Total feed fed annually to the entire poultry enterprise per 100 birds (hens and pullets) in the laying flock on October 1.

Grains:			
Shelled corn	2055 lbs.	or	36.7 bu.
Wheat	1042 lbs.	or	17.4 bu.
Oats	387 lbs.	or	12.1 bu.
Mash[2]	4016 lbs.	or	40.2 cwt.
Shell and grit	188 lbs.	or	1.9 cwt.
Total	7688 lbs.		

[1] Data obtained from 18 farm poultry record keepers with a total of 5948 birds on October 1. The average number of hens in these flocks for the year was 4656 and the number at the end of the year was 2829.

[2] See footnote 3, page 83, for further information regarding the probable ingredients and desired protein content of the mash. See also text, Part C, below.

C. *The total feed consumed by the entire poultry enterprise* on these farms per 100 birds (hens and pullets) in the laying flock on the first of October was 7688 pounds. This includes the 5816 pounds of feed fed to the laying flock during the year; and the 1872 pounds of feed fed to the young stock raised to provide the 52 pullets required for replacements. In other words, for each 100 birds (hens and pullets) housed on October 1, these farmers fed 7688 pounds of concentrates during the year. (See Table 68, part C.)

If, in addition to the scratch grain, home grown grains are used to provide part of the ingredients of the mash, the amount that home grown grains may

make up of the total feed consumed by the entire poultry enterprise per 100 birds in the laying flock October 1 will be, if the ration is to be fairly well balanced, approximately 60 bushels of corn, 34 bushels of wheat and 25 bushels of oats, along with 15 cwt. of purchased protein supplement, minerals, fish oil, etc. (See footnote 3, page 83.)

III. *Feed Consumed by Heavy Breed Flocks with Average or Better Production and Receiving Good Care and Management*

Poultry records on 27 farms on which the heavy breeds were kept under good care and management provide a good guide to the feed requirements for heavy breed flocks similarly managed.[1] These 27 flocks contained on October 1, 4819 birds or 178 per flock. In most cases well balanced rations were fed. Farmstead gleanings and kitchen waste generally contributed some to the feed consumed by the birds. Egg production ranged from 9 to 12 dozen eggs per hen per year.

For each 100 birds (hens and pullets) in these flocks on October 1, 45 remained on September 30, one year later, the difference being accounted for by home consumption, culling, and mortality. To maintain the flocks on these farms, sufficient young stock was raised each spring and summer to provide the 55 pullets needed to bring the flocks to 100 birds (hens and pullets) on October 1.

A. *The feed consumed per year by the laying flock* on these 27 farms averaged per 100 birds in the flocks on October 1, 6987 pounds of concentrates.[2] This was made up of 2801 pounds of shelled corn, 1162 pounds of wheat, 228 pounds of oats, 2621 pounds of mash (a small part of which was provided by home produced feeds and the balance purchased), and 175 pounds of shell and grit. (See Table 69, part A, page 87.)

B. *The feed consumed by the young stock* in the production of the 55 mature pullets needed to restore the laying flock to 100 birds on October 1 includes the feed fed to the cockerels until they are disposed of and to the pullets until they are taken into the laying flock on October 1. This amounted to 2445 pounds of concentrates, which was made up of 711 pounds of ground or cracked corn, 396 pounds of ground wheat, 88 pounds of ground oats, 1247 pounds of mash, and 3 pounds of grit. (See Table 69, part B, page 87). Approximately 165 chicks of mixed sexes were brooded per 55 pullets needed for replacements.

C. *The total feed consumed by the entire poultry enterprise* on these farms per 100 birds (hens and pullets) in the laying flock on October 1, was 9432 pounds. This includes the 6987 pounds fed to the laying flock and the 2445 pounds fed to young stock raised for replacements. In other words, for each 100 birds (hens and pullets) housed on October 1, these farmers fed 9432 pounds of concentrates during the year. (See Table 69, part C, page 87.)

[1] The poultry records kept on these farms were under the supervision and in cooperation with the Poultry Extension Specialists at the Ohio State University.

[2] The quantity of feed consumed annually by the heavy breed laying flock for which records were available was a little less than that consumed by the laying flocks of high producing leghorns. This is due to the fact that culling was slightly heavier and it was done a little earlier in the year among the heavy breed flocks than among the leghorn flocks on which records were available.

If, in addition to scratch grain, home grown grains are used to provide part of the ingredients of the mash, the amount that home grown grains may make up of the total feed consumed by the entire poultry enterprise per 100 birds in the laying flock October 1 will be, if the ration is to be fairly well balanced, approximately 81 bushels of shelled corn, 42 bushels of wheat, and 23 bushels of oats, along with 17 cwt. of purchased protein supplement, minerals, fish oil, etc. (See footnote 3, page 83.)

Table 69. — Feed consumed by heavy breed flocks with average or better egg production and receiving good care and management[1]

A — The feed fed per year to the laying flock for each 100 birds (hens and pullets) in the flock on October 1.

Grains:			
Corn	2801 lbs.	or	50.0 bu.
Wheat	1162 lbs.	or	19.4 bu.
Oats	228 lbs.	or	7.1 bu.
Mash	2621 lbs.	or	26.20 cwt.
Shell and grit	175 lbs.	or	1.75 cwt.
Total	6987 lbs.		

B — The feed fed to the young stock in the production of 55 mature pullets required to restore the laying flock of 100 birds (hens and pullets) on October 1.

Grains:			
Corn (ground or cracked)	711 lbs.	or	12.7 bu.
Wheat (ground or whole)	396 lbs.	or	6.6 bu.
Oats (ground or whole)	88 lbs.	or	2.7 bu.
Mash	1247 lbs.	or	12.5 cwt.
Shell and grit	3 lbs.	or	.03 cwt.
Total	2445 lbs.		

C — The total feed fed annually to the entire poultry enterprise per 100 birds (hens and pullets) in the laying flock on October 1.

Grains:			
Corn	3512 lbs.	or	62.7 bu.
Wheat	1558 lbs.	or	26.0 bu.
Oats	316 lbs.	or	9.8 bu.
Mash[2]	3868 lbs.	or	38.7 cwt.
Shell and grit	178 lbs.	or	1.8 cwt.
Total	9432 lbs.		

[1] Data obtained from 27 farm Poultry Record Keepers with a total of 4819 birds on October 1. The average number of hens in these flocks for the year was 3620 and the number at the end of the year was 2163.

[2] See footnote 3, page 83 for further information regarding the probable ingredients and desired protein content of the mash. See also text, Part C, page 86.

IV. *Feed Consumed by the Farm Poultry Flock, Receiving the Minimum of Feed and Care, Kept Primarily to Supply Home Consumption Needs*

A group of 17 farms in Ohio on which farm cost account records were kept, were feeding during the period of a year per 100 birds on October 1, 4130 pounds of concentrates. This was made up of 2800 pounds of shelled corn, 300 pounds of wheat, 640 pounds of oats, 75 pounds of dry milk (the equivalent of 83 gallons of liquid skimmilk), and 315 pounds of purchased mash. (See Table 70, page 88.) This included the feed fed during the year to both the laying flock and to the young flock per 100 birds on October 1.

Table 70. — Feed consumed by the farm poultry flock receiving the minimum of feed and care, kept primarily to supply home consumption needs[1]

A — The feed fed for a period of one year per 100 birds on October 1, including the feed for the young stock required to restore the flock to 100 birds at the end of the year.

Grains:			
Corn	2800 lbs.	or	50 bu.
Wheat	300 lbs.	or	5 bu.
Oats	640 lbs.	or	20 bu.
Skim milk (dry)	75 lbs.	or	83 gal.
Mash, etc.	315 lbs.	or	3.2 cwt
Total	4130 lbs.		

[1] Data obtained from 17 Greene County cost account farms. The flocks on these farms on October 1, frequently contained in addition to hens and pullets several male birds for use as breeders and to be killed for family consumption.

On 20 farms in Minnesota, on which the poultry enterprise was kept primarily to supply the home consumption needs and managed similarly to the 17 Ohio farms referred to above, the feed fed annually per 100 birds in the laying flock averaged 4243 pounds of grain and 304 pounds of skim milk.[1]

Under the system of management commonly followed on these farms, the flock, which was usually of mixed types and breeds, seldom contained as many as 150 birds on October 1, more often 100 or less birds on this date. The flock as a rule on October 1 included, in addition to hens and pullets, several cockerels. The replacement stock needed each year, except in cases of high mortality, was generally not as large as in the case of the commercial flock, as the hens were often kept for three or more seasons and no culling was done.

The birds received primarily a grain ration in which corn predominated. Farmstead gleanings and kitchen waste comprised a relatively large part of the feed consumed by the birds. Egg production was low, ranging between 4 and 6 dozen eggs per hen per year, with the heaviest production coming in the spring months.

V. *Feed Consumed by the Young Stock in the Production of 100 Mature Pullets*

On 26 farms on which poultry records were kept, 10,002 mature Leghorn pullets were produced. To grow these pullets to maturity and the cockerels to normal market weight, 3601 pounds of concentrates were fed per 100 mature pullets produced. (See Table 71, page 89.) Approximately 300 baby chicks of mixed sexes were brooded on these farms in the production of each 100 mature pullets.

If sexed chicks are brooded, the feed required per 100 mature pullets produced will be reduced by an amount equal to that consumed by the cockerels. Usually, when chicks of mixed sex are brooded approximately 40 out of each 100 are sold as cockerels at from 10 to 14 weeks of age. For Leghorn cockerels, the feed required per cockerel varies between 8 and 10 pounds per bird, depending upon age when they are sold. Thus, if sexed chicks were brooded, the total quantity of feed required to produce 100 mature pullets would be

[1] Minnesota Agricultural Experiment Station Bulletin 205.

reduced from 3601 pounds of concentrates to approximately 2400 to 2600 pounds.

On the farms of 12 poultry record keepers on which 1696 mature heavy breed pullets were raised, an average of 4447 pounds of concentrates were fed per 100 mature pullets. This included the feed fed to the cockerels until sold and to the pullets until mature. (See Table 71, below.)

On 46 New York farms on which cost account records were kept during 1937, 96,167 chicks were started. For each 100 chicks started 34.5 pullets were produced, 36.4 broilers sold, 2.9 birds otherwise disposed of, and 26.2 birds died. On these farms, 719 pounds of mash and 458 pounds of grain, a total of 1177 pounds of concentrates, were fed per 100 chicks started, or 34.1 pounds of concentrates per pullet produced.[1]

Table 71. — Feed consumed by the young stock in the production of 100 mature pullets on Ohio farms on which poultry records were kept and analyzed

Feed	Leghorns[1]		Heavy breeds[2]	
Grain:				
Corn	823 lbs.	14.7 bu.	1293 lbs.	23.1 bu.
Wheat	447 lbs.	7.5 bu.	720 lbs.	12.0 bu.
Oats	147 lbs.	4.6 bu.	160 lbs.	5.0 bu.
Mash	2167 lbs.	21.7 cwt.	2268 lbs.	22.7 cwt.
Shell and grit	17 lbs.	0.2 cwt.	6 lbs.	0.06 cwt.
Total	3601 lbs.		4447 lbs.	

[1] The data obtained from 26 Farm Poultry Record Keepers with a total annual production of 10,002 mature pullets from day-old chicks. The feed requirements also include that consumed by the broilers and those that died.

[2] Data obtained from 12 Farm Poultry Record Keepers with a total annual production of 1696 mature pullets from day-old chicks. The feed requirements also include that consumed by the broilers and those that died.

VI. *Feed Consumed per Layer During a 12-Month Period*

A flock that, on October 1, contained 100 birds (hens and pullets) will have been reduced to approximately 50 birds at the end of 12 months, due to mortality and culling, according to the experience of poultrymen in Ohio. The average number of birds in such a flock during a 12-month period will vary somewhat with the time the mortality and culling occur. In the high producing Leghorn flock receiving better than average care and management, on which poultry records were kept and analyzed in Ohio, the average number of birds for the year per 100 birds (hens and pullets) in the flock on October 1 was 79.6. In the Leghorn flock receiving average management, the average number in the flock per 100 on October 1 was 78.2, and in the heavy breed flocks 75.1.

When the 7155 pounds of concentrates that were fed to each 100 birds in the laying flock on the farm on which better than average producing Leghorn flocks are kept, are divided among the average number of layers (79.6) in the flock during the year, it gives the quantity fed per layer for a period of a year. In this case it was 89.9 pounds. In the case of the average producing Leghorn flocks, the amount of feed fed per layer for a 12-month period was 74.3, and for the heavy breed flocks 93.0 pounds. (See Table 72, page 90.)

[1] Cornell Extension Bulletin 395.

Table 72. — The average amount of feed fed per layer during a 12-month period according to records kept by Ohio poultrymen[1]

Feed	High producing Leghorn flocks	Average producing Leghorn flocks	Good producing heavy breed flocks
Grain:			
Corn	25.7 lbs.	20.8 lbs.	37.3 lbs.
Wheat	13.2 lbs.	10.3 lbs.	15.5 lbs.
Oats	8.1 lbs.	4.0 lbs.	3.0 lbs.
Mash	39.6 lbs.	36.9 lbs.	34.9 lbs.
Shell and grit	3.3 lbs.	2.3 lbs.	2.3 lbs.
Total	89.9 lbs.	74.3 lbs.	93.0 lbs.

[1] Computed by dividing the average number of layers in the flock during the year into the total feed consumed by the laying flock during the year. The feed required to raise replacement stock is not included.

Table 73. — Feed consumed during a 12-month period per bird (Leghorn hens) when fed a scratch grain (Corn 66.7, wheat and oats 33.3) and mash containing different amounts of animal protein (meat scraps and tankage)[1]

	Amount of animal protein contained in the mash			
	34 per cent	20 per cent	10 per cent	0 per cent
Number of trials	6	4	4	6
Scratch grain:				
Corn, lbs.	34.6	34.0	34.6	33.0
Oats and wheat, lbs.	17.3	17.0	17.3	16.0
Mash:				
Bran, lbs.	6.6	7.8	8.1	7.0
Middlings, lbs.	6.6	7.8	8.1	7.0
Corn meal, lbs.	6.6	7.8	8.1	7.0
Meats or tankage, lbs.	10.0	5.8	2.7	0
Total feed, lbs.	81.7	79.9	78.9	70
Eggs per hen	126	120	112	61

[1] Missouri Agricultural Experiment Station Bulletin 225. The feed required to raise replacement stock is not included.

Table 74. — Feed consumed during a 12-month period per bird (heavy breed pullets) when fed a scratch grain (corn 70, oats 30) and mash containing different amounts of meat scrap[1]

	Amount of meat scrap contained in the mash			
	20 per cent	15 per cent	10 per cent	5 per cent
Number of trials	3	3	3	3
Scratch grain:				
Corn, lbs.	36.6	35	35.4	32.5
Oats, lbs.	15.6	15	15.1	13.9
Mash:				
Bran and middlings, lbs.	13.5	16.9	16.2	17.0
Corn meal, lbs.	6.7	8.4	8.1	8.5
Ground oats, lbs.	6.7	8.4	8.1	8.5
Meat scraps, lbs.	6.7	5.9	3.6	1.8
Total feed, lbs.	85.8	89.6	86.5	82.2
Eggs per pullet	146	133	126	109

[1] Kentucky Agricultural Experiment Station Bulletin 260. The feed required to raise replacement stock is not included.

On 46 poultry farms in New York state on which there was an average of 33,135 birds in the laying flocks during 1937, the amount of feed fed per layer during a 12-month period was 86 pounds.[1] The average production was 150 eggs per layer per year.

An analysis of 344 records kept on poultry farms during a 3-year period in the state of Delaware, on which there was an average of 179,224 birds in the laying flocks during a 12-month period, were fed 81.7 pounds of concentrates per layer during the 12 months. On these farms this was made up of 38.9 pounds of grain, 40.1 pounds of mash, 2.5 pounds of grit and shell, and 0.2 pound of miscellaneous feed.[2] For each 100 birds (hens and pullets) in these Delaware flocks on October 1, 18.8 birds died during the next 12 months and 30.4 birds were removed as culls. All of the Delaware flocks except two were of Leghorn breeding.

A. *When rations containing different amounts of meat scraps and tankage are fed.*—The amount of feed consumed during a 12-month period in numerous trials in which Leghorn hens were used, was 81.7 pounds per hen on the ration containing the most animal protein; as the amount of animal protein in the ration was reduced, the amount of feed consumed per bird decreased somewhat, and in the trials where no animal protein was fed 70 pounds of feed per bird was consumed. The pen receiving the ration with the most animal protein produced more than twice as many eggs per hen per year as those receiving no animal protein, and as the amount of animal protein in the ration was reduced egg production per bird decreased. In the trials in which no animal protein was fed, they produced on the average only 61 eggs per bird annually. (See Table 73, page 90.)

In similar trials in which heavy breed pullets were fed rations containing varying amounts of animal protein, the results obtained were much like those where Leghorn hens were used. (See Table 74, page 90.)

B. *When various grain rations are fed in addition to skimmilk.*—On a ration of corn and skimmilk, heavy breed pullets consumed 79.9 pounds of dry concentrates per pullet during a 12-month period. On a ration of corn, oats, and skimmilk, 85.2 pounds were consumed per pullet; 78.9 pounds were consumed per pullet when fed corn, wheat, and skimmilk; and 77.5 pounds when fed corn, wheat, oats, and skimmilk. There was, in general, but little evidence to indicate that the type or combination of grain would materially influence the total consumption per bird over a period of 12 months. (See Tables 75 and 76, page 92.)

C. *When cod liver oil is included in the ration.*—Leghorn birds that were fed rations containing some cod liver oil consumed, during a 12-month period, 85 pounds of feed per bird, according to records on poultry flocks in the State of Delaware.[1] The records on flocks receiving rations that contained no cod liver oil showed that the average amount of feed consumed per bird was 83 pounds.

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[1] Cornell Extension Bulletin 395.

[2] Delaware Agricultural Experiment Station Bulletin 202.

Table 75. — Feed consumed during a 12-month period per bird (heavy breed type) when fed sour skimmilk and grain[1]

	Corn alone	Corn 70 Oats 30	Corn 70 Wheat 30	Corn 60 Oats 20 Wheat 20
Number of trials	2	2	2	2
Grain consumed:				
Corn, lbs.	71	52.5	49.0	40.8
Oats, lbs.	..	22.5	.	13.6
Wheat, lbs.	.		21.0	13.6
Sour skimmilk, gallons	14	16	14	15
Total feed including milk solids, lbs.	79.9	85.2	78.9	77.5
Eggs produced per pullet	159	164	178	175

[1] Kentucky Agricultural Experiment Station Bulletin 260. The birds received only sour skimmilk to drink. Feed required to raise replacement stock is not included.

Table 76. — Feed consumed during a 12-month period per bird (Leghorn pullets) when fed sour skimmilk and combinations of various grains, fed whole and fed ground[1]

	Scratch grain— Whole wheat 66 lbs. Whole oats 34 lbs. Mash—None	Scratch grain— Whole wheat 35 lbs. Whole corn 35 lbs. Whole oats 30 lbs. Mash—None	Scratch grain —none Mash — Ground wheat 66 lbs. Ground oats 34 lbs.	Scratch grain —none Mash — Ground wheat 35 lbs. Ground corn 35 lbs. Ground oats 30 lbs.
Scratch grain:				
Wheat, whole, lbs.	38	20	..	..
Corn, whole, lbs.	..	20	..	..
Oats, whole, lbs.	19	18	..	..
Mash:				
Wheat, ground, lbs.	..	..	35	18
Corn, ground, lbs.	..	..	..	18
Oats, ground, lbs.	..	.	17	16
Sour milk (liquid)	194	189	176	170
No. of eggs per pullet, per year	257	249	250	248
Percentage of mortality	15	15	5	5

[1] Washington Agricultural Experiment Station Bulletin 210 (1927). Liquid sour skimmilk was available at all times; no water other than that in the milk was supplied. Feed required to raise replacement stock is not included.

Table 77. — Feed consumed during a 12-month period per bird when fed by an all-mash system and when fed by scratch grain and mash system[1]

	All-mash system[2]		Scratch grain and mash[3]	
	100 heavy breed pullets	100 Leghorn pullets	100 heavy breed pullets	100 Leghorn pullets
Scratch grain, lbs.	...	...	41.5	37.1
Mash, lbs.	85.0	77.7	42.7	44.6
Total feed, lbs.	85.0	77.7	84.2	81.7
Eggs per pullet	167	182	174	182
Number of deaths	9	9	6	8

[1] Kentucky Agricultural Experiment Station Bulletin 294. The feed required to raise replacement stock is not included.

[2] The all-mash ration consisted of — ground yellow corn 600 lbs., bran 100 lbs., middlings 100 lbs., meat scrap 75 lbs., dried buttermilk 25 lbs., ground limestone 25 lbs., bone meal 20 lbs., sald 10 lbs., grit and shell.

[3] The scratch grain and mash ration consisted of scratch grain, corn only. Mash ration same as all mash except 150 lbs. of corn instead of 600 were used.

D. *When layers are fed under an all-mash system and a scratch grain and mash system.*—In trials conducted at the Kentucky Agricultural Experiment Station in which both heavy and light breeds of chickens were used, there was no material difference in the quantity of feed consumed per bird during a 12-month period when managed under an all mash feeding system or under a scratch grain and mash system. (See Table 77, page 92.)

E. *When the mash part of the ration is fed dry and when all or part is fed wet.*—No appreciable difference was found to exist either in the quantity of feed consumed during a 12-month period when mash was fed dry or when all or part was fed wet. Records kept on a large number of poultry farms in the state of Delaware on which the birds were more than 99 per cent Leghorns, showed that 82 pounds of dry concentrates were consumed per bird receiving a dry mash as compared to 84 pounds per bird receiving all or part of the mash in a wet form.[1]

F. *When fed a ration containing green feed during the winter.*—Leghorn birds having access to summer range and confined during the winter, when fed some green material in addition to the regular concentrate ration, consumed 84 pounds of feed per bird during a period of 12 months. Those flocks having access to summer range and confined during the winter, but receiving no green material, consumed 81 pounds of feed per bird.[1]

[1] Delaware Agricultural Experiment Station Bulletin 202.

☞ All data on the quantity of grain and hay consumed or required annually or for a given amount of production in this bulletin are on a dry weight basis, unless otherwise stated. Thus an adjustment for normal shrinkage due to loss of moisture after storing must be made for corn and hay before calculating the amount of livestock that these feeds will support. (See text, page 6, for information on the determination of the quantity of farm-produced feeds available for feeding.)

Common Methods for

Computing the Quantities of Stored Feeds

◆

Capacity of the Round Silo in Tons

(Table from Kansas Investigation)

	Inside Diameter in Feet										
	8	9	10	11	12	13	14	15	16	17	18
Height in Feet	Capacity in Tons										
1	0.8	1.0	1.3	1.5	1.8	2.1	2.5	2.8	3.2	3.6	4.1
2	1.6	2.1	2.5	3.1	3.7	4.3	5.0	5.7	6.5	7.3	8.2
3	2.5	3.1	3.8	4.7	5.5	6.5	7.6	8.7	9.9	11.1	12.5
4	3.3	4.2	5.2	6.3	7.5	8.8	10.2	11.7	13.3	15.0	16.8
5	4.2	5.3	6.6	7.9	9.4	11.1	12.9	14.8	16.8	19.0	21.2
6	5.1	6.4	7.9	9.6	11.4	13.4	15.6	17.9	20.3	23.0	25.7
7	6.0	7.6	9.4	11.3	13.5	15.8	18.4	21.1	24.0	27.1	30.3
8	6.9	8.7	10.8	13.1	15.6	18.2	21.2	24.3	27.7	31.2	35.0
9	7.9	9.9	12.3	14.8	17.7	20.7	24.0	27.6	31.4	35.5	39.7
10	8.8	11.1	13.7	16.6	19.8	23.3	27.0	31.0	35.2	39.8	44.4
11	9.8	12.4	15.2	18.5	22.0	25.8	29.9	34.4	39.0	44.1	49.3
12	10.7	13.6	16.8	20.3	24.2	28.4	32.9	37.8	42.9	48.5	54.2
13	11.7	14.8	18.3	22.2	26.4	31.0	35.9	41.2	46.9	53.0	59.3
14	12.7	16.1	19.9	24.1	28.6	33.6	39.0	44.7	50.9	57.5	64.4
15	13.7	17.4	21.4	26.0	30.9	36.3	42.0	48.3	54.9	62.0	69.3
16	14.7	18.7	23.0	27.9	33.2	38.9	45.2	51.8	59.0	66.6	74.6
17	15.8	19.9	24.6	29.8	35.5	41.6	48.3	55.4	63.0	71.2	79.7
18	16.8	21.2	26.2	31.7	37.8	44.3	51.4	59.0	67.1	75.8	84.8
19	17.8	22.5	27.8	33.7	40.1	47.0	54.6	62.6	71.2	80.4	90.0
20	18.8	23.8	29.4	35.6	42.4	49.7	57.8	66.2	75.4	85.0	95.2
22	20.9	26.5	32.6	39.5	47.0	55.2	64.0	73.5	83.6	94.4	105.6
24	23.0	29.1	35.9	43.5	51.7	60.7	70.4	80.9	91.9	103.9	116.1
26	25.1	31.8	39.2	47.5	56.5	66.3	76.9	88.3	100.3	113.4	126.8
28	27.3	34.5	42.6	51.5	61.3	72.0	83.4	95.8	108.9	123.1	137.6
30	29.4	37.2	45.9	55.6	66.1	77.7	90.1	103.4	117.6	132.8	148.6
32	31.6	40.0	49.3	59.7	70.9	83.4	96.7	111.0	126.2	142.6	159.5
34	33.7	42.7	52.7	63.8	75.8	89.1	103.3	118.6	134.8	152.3	170.5
36	35.9	45.4	56.1	67.9	80.7	94.8	110.0	126.2	143.5	162.1	181.4
38	38.1	48.2	59.5	72.0	85.5	100.5	116.6	133.8	152.1	171.9	192.4
40	40.2	50.9	62.8	76.0	90.4	106.2	123.2	141.4	160.7	181.6	203.3

Determining Quantity of Silage

The figures given represent settled silage and do not refer to the height of the silo or the height of silage prior to settling.

Method for determining the amount of silage on hand at any time: (a) If the amount fed is known, subtract the tonnage fed from the total tons of settled silage on hand before feeding was begun; (b) if the tonnage fed is not known it can be estimated by determining how many feet of settled silage have been fed (assuming this to be 10 feet out of a silo 12 feet in diameter) and then ascertaining from the table the tonnage contained in a silo 10 feet high and 12 feet in diameter. According to the table this amounts to 19.8 tons. If the silo originally contained 28 feet of silage after settling or 61.3 tons, there would remain in the silo 41.5 tons after feeding the first 10 feet of settled silage. If 4 more feet are fed and it is desirable to know the quantity of silage remaining, ascertain from the table the tonnage contained in a silo 14 feet high and 12 feet in diameter and deduct this from the original amount.

Rules for Measuring Bins and Cribs

To find bushels of grain or shelled corn in bin: Multiply length by the width by the depth (in feet) and divide by 1¼.

To find the approximate number of bushels of ear corn in crib: Multiply length by the width by the average depth (in feet) and divide by 2½. If the crib is round, find the cubic feet by multiplying the distance around the crib by the diameter by the depth of the corn and divide by 10.

For information on how to compute the amount of hay and corn stover, see pages 6 and 7.

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Shrinkage of Ear Corn by Months for the Years 1903-1913[1] at Urbana, Illinois

(Expressed in percentage)

Month	1903	1905	1906	1907	1909	1910	1911	1912	1913	Average for 9 yrs.
Nov.....	.8	2.5	1.1	(—.1)	1.8	...	1.9	...	...	1.3
Dec.....	3.2	5.5	2.8	2.2	4.5	1.2	5.0	1.7	...	3.3
Jan.	4.5	6.7	3.3	4.5	4.8	2.7	6.8	3.0	1.1	4.2
Feb.	5.6	8.6	4.9	6.3	6.5	3.8	7.5	3.9	2.3	5.5
Mar....	6.9	8.5	7.3	9.4	9.2	6.9	7.6	5.0	1.9	7.0
Apr. ...	11.1	10.0	10.5	12.4	13.5	8.7	11.4	7.2	5.1	10.0
May ...	15.4	13.6	11.9	13.8	13.7	12.4	17.1	11.2	8.9	13.1
June ...	17.9	14.2	13.2	16.8	15.7	15.1	20.3	13.2	11.3	15.3
July....	19.0	15.3	14.1	18.0	15.7	16.8	20.3	13.6	12.5	16.2
Aug. ...	20.2	15.1	14.8	19.0	15.6	16.9	21.1	13.5	13.3	16.6
Sept. ...	19.8	15.2	15.2	20.1	14.8	15.4	21.3	13.7	12.1	16.4
Oct.....	19.8	...	15.5	20.6	14.9	14.7	21.6	12.2	13.0	16.5
Nov.....	19.9	...	15.1	20.2	15.4	14.7	21.6	11.2	12.4	16.3
Dec. ...	...	...	...	...	...	...	...	10.1	...	...

[1] With the exception of 1904 and 1908, for which data are unavailable. Source: Agricultural Experiment Station Bulletin, Ill., 295.

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OF AGRICULTURE

AGRICULTURAL EXTENSION SERVICE
H. C. RAMSOWER, Director
Columbus, Ohio

FREE—Cooperative Agricultural Extension
Work—Acts of May 8 and June 30, 1914

Printed by
THE OHIO STATE UNIVERSITY PRESS
Columbus, Ohio